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Contents:

	PAGE
The Spirit of Research	717
Among the Wholesalers	718
Caged Birds	718
Assisted Wiring	718
Prospects in France	718
The Institute of Fuel	719
Hire-Purchase	719
The O.L.A.	719
Electrical Christmas Gifts	719
Modern Lighting—II, by A. B. Read *(illus.)*	720
Photo-electric Cells—I, by T. Thorne Baker *(illus.)*	722
Rating of Supply Undertakings, by H. T. Seymour	724
A New Traffic Signal, by F. G. H. Macrae *(illus.)*	725
A New Cable, by T. Harden *(illus.)*	726
Electricity for the Home *(illus.)*	727
The Institute of Fuel, by Sir David Milne-Watson	729
Business and Industrial Notes	730
Lighting and Power Notes	734
Tramway and Railway Notes	736
Telegraph and Telephone Notes	736
Radio Notes	736
Contract Information	737
Forthcoming Events	739
Notes	739
Institution Notes	742
Our Personal Column	742
Financial Section—	
New Companies Registered	743
Official Returns of Electrical Companies	744
City Notes	744
Stocks and Shares	745
Installation Materials for France	747
The Marking of Imported Meters	748
Round-tank Switchgear *(illus.)*	750
The Generation of Electricity	751
Overhead Lines Association	752
Research in Industry, by Clifford C. Paterson *(illus.)*	753
New Electrical Devices, Fittings, and Plant *(illus.)*	756
Correspondence—	
Temperature Rise and the B.E.A.M.A.	758
Phasing out E.h.p. Cable Joints	758
"Tales Engineers Tell"	758
Mandi Hydro-Electric Scheme	758
A Motor Advertisement	759
Assisted Wiring Schemes	759
Published Specifications	759
Trade Mark Applications	759
New Work for Contractors	760

The Spirit of Research.

THE need for properly organised research as an essential factor in the development of all sections of the electrical industry, supply as well as manufacturing, has often been voiced in these columns.

We find ourselves quite in accord with the theme of the brilliant address which MR. C. C. PATERSON delivered last week as President of the Institution of Electrical Engineers. Mr. Paterson claimed that research should not be regarded as something to fall back upon when empirical methods had been found wanting, but as the very basis of industry. This calls for recognition, with all its implications, that on research industrial progress depends. It is the rejection of the doctrine of "muddling through," and, although the major influence of empiricism has not been without its virtues under conditions that are now past, its sphere for the future, in a world becoming increasingly organised, should be abbreviated to the dimensions hitherto held to be suitable for research.

The full benefit of research is to be obtained only if all sections of the industry do their shares, not only financially but also in the exercise of thought. Mr. Paterson chose a good example in voltage regulation, drawing a comparison between the achievements of manufacturers in producing apparatus within close limits by careful study of conditions and the absence of any attempt by supply undertakings to gather collated statistical data regarding voltage variations at different hours of the day. With the rapidly growing cooking load, for example, satisfaction among consumers will depend largely upon their being able to rely on a constant voltage, within limits, in default of which it is probable that blame will be thrown on the apparatus. It may be that the present statutory limits of plus or minus four per cent. are too narrow and that the cost of rigid compliance would be more than it is worth to the consumer, but it is hardly reasonable to ask for their extension without evidence as to what conditions actually do obtain and what limits are practicable.

It is, in our opinion, the case that uniformity of voltage of electricity supply has been considerably outstripped by that of appliances to be used on it, as Mr. Paterson claims. This, however, is only to be expected,

as a matter both of practice and of psychology. Research and the research outlook in manufacture have naturally preceded their equivalents in operation. The chief concern of the supply engineer in the early days of the industry was to keep the supply going, and he had to be as adaptable to unforeseen conditions as a sailor. He had to meet emergencies quickly and so became an adept at "faking" apparatus to meet pressing, if passing, needs. He also acquired the habit of demanding a margin of safety in plant that his experience taught him to be requisite. This state of affairs was largely due to the lack of proper research facilities among manufacturers who could not do otherwise than use supply undertakings for full-scale demonstrations of immature ideas. With the development of research and experience among manufacturers, operation became less of an art and more of a science. A habit of mind is not to be altered all at once, but it is evident on all hands that the outlook of supply engineers is developing in line with modern requirements, and that includes the acquisition of the research temperament, the desire to explain the mysteries of the world, the "why" as well as the "how" of things.

We cannot here comment on many other aspects of the presidential address, which is given in abstract on a later page. By no means the least interesting part was that devoted to illumination, particularly the ocular demonstrations, which do not lend themselves to description. Only those who were present can really appreciate what the others missed, although a larger attendance would have made a severe tax on the accommodation.

Among the Wholesalers.

If rumour be not a lying jade, there is movement in the valley of the wholesalers. We are, and always have been, believers in organisation—efficient organisation—of the various sections of the electrical industry, for it is only by means of unity in its different parts that there can be anything approaching to proper co-operative understanding and working throughout the whole. It will be remembered that some time ago a number of the more important members of the Electrical Wholesalers' Federation considered that their interests would be better served by forming themselves into the Electrical Merchants' and Manufacturers' Association. The Electrical Wholesalers' Federation continued; later the secretary resigned and the appointment was advertised. Since then, we understand, a movement has been in progress for bringing into yet another organised body the large number of small wholesale factors who were not previously connected with any association. Whether the movement will meet with success or not, who can say? What we are tempted to wonder is whether the position of the individual wholesaler will ultimately be strengthened by the existence of too many bodies to represent his interests. This is not the only department in which there has been a restlessness to bring about what seems remarkably like duplication or overlapping of effort. The merits of rationalisation and amalgamation continue to be the subject of critical discussion in various quarters, and the organisation of contractors, big wholesalers or merchants, other wholesalers, and, if possible, all retailers, into separate strong organisations would seem the most promising method for rendering negotiations with other sections easier and for securing the redress of grievances. We claim no originality for the fear that a house divided against itself cannot stand.

Caged Birds.

We have a very real sympathy for men in the electricity supply industry who are full of enthusiasm for their job—want to make a fine thing out of it—are dead confident that they know how to do it—but are stopped by somebody else.

That somebody has fastened the cage door with the hand of authority and one more enterprising creature beats its wings impatiently upon the bars until one day some opportunity of escape occurs and he is missing—is gone to the freedom that somebody else offers him for the full play of his faculties, to a place where his brilliant ideas will less frequently be "turned down."

The bird has taken flight not through any lack of appreciation of the value of the ripe experience of that "somebody," but because of the latter's sheer self-satisfaction, obstinacy—contentment with present methods and rock-like indisposition to move. Let others do this or that—*we* do not need to adopt such devices—we have done very well so far by going our own way. New men may come and new men may go, but we stay on for ever!

Of course these actual words are not used, but they come remarkably near to representing sentiments that are cherished in some quarters where the wisdom, nay, the elementary justice, of giving a sympathetic hearing to suggestions for progress is not recognised.

It is deplorable that it should be so, that dead men's shoes should have to be waited for. On the other hand, how delightful it is to meet the electrical man of lengthy and wide knowledge and experience who, the while he becomes mellowed, can recognise the need for change and happily—almost jovially—shapes his policy in accordance with it. What a great encourager is such to the rising generation and what a help to our wonderful electrical industry!

Assisted Wiring.

In our "Correspondence" columns to-day will be found clear proof of the truth of paragraph 13 of the report on assisted wiring, &c., of the Electricity Commissioners' committee. This paragraph emphasises the necessity for the undertaking to offer facilities rather than to wait for the public to ask for them, for the very good reason that few people like to ask for credit unless they are sure that it is available. The experience of Mr. B. T. Hawkins, borough electrical engineer and manager, Wallasey, is instructive. Within six months of the inception of his assisted wiring scheme, the number of applicants is about 26 per cent. of the previous number of consumers. When all these connections have been made, the total number of consumers will be about 70 per cent. of the number of inhabited houses.

The scheme under mention provides for an additional payment of 2d. per kWh, until a definite amount of energy, depending upon the size of the installation, has been consumed. An electric iron is included in the installation in every case—a commendable method of introducing the consumer to one of the most satisfactory of electrical appliances.

Prospects in France.

There is a general belief among a large section of British electrical manufacturers that there is little business to be done in some, if not most, of the Continental markets. While no doubt many difficulties make the path of trade with the Continent anything but smooth, that is not to say that they present insurmountable barriers. As a matter of fact, our electrical trade with the principal Continental markets has been well sustained, and in some instances increased, during the past four or five years. In the case of France, with which country we deal in this issue in the matter of electrical contractors' supplies, the value of British electrical goods and apparatus imported has been in the neighbourhood of £250,000 per annum since 1925, in spite of the decline in values. The Department of Overseas Trade report which we review gives a somewhat mixed impression of the possibilities of selling British electrical goods in France. The position in Paris would appear to offer little hope, but the Consular officers at Lille and Le Havre consider that much more might be done if appropriate steps were taken by British suppliers. This view was upheld by a correspondent in our issue of October 17th, who spoke from personal experience. This writer put the question: "How are we to know what she [France] wants, or what we make and she

doesn't?" and answered it by saying: "Go there and find out!"

Every report on every market urges that the best method of approach is the personal visit, and we are convinced that this is true. Visits to South America, China, and other distant markets are not easily arranged, but France is close at hand and the principal centres could be visited in a very short time.

The Institute of Fuel.

The second presidential address of Sir David Milne-Watson to the Institute of Fuel is as full of sound matter as was his first, upon which we commented in our leading columns of November 8th last year.

The portion of the address, an abstract of which is given elsewhere in this issue, with which we are here concerned is that containing a plea for co-operation between gas and electricity. That the scope for joint working between the two great services is very large is quite evident. It is, indeed, evident from the existence of the Institute of Fuel itself, of which so many eminent electrical engineers are Fellows, and also from the good work done by the Illuminating Engineering Society and the Association of Public Lighting Engineers.

In addition to the common meeting ground provided by institutions mainly technical in character, there is the wide field for joint action represented by legislative proposals and the relations between local authorities and public services, and also propaganda against atmospheric pollution by smoke.

An interesting development of useful collaboration has been the use of coke breeze, with coal, in electric power stations, *e.g.*, Deptford. The lower-grade fuel promises satisfaction for steady loads, and the future may see coke thus burned producing electricity to meet the steady night demand of electric water heaters.

Both gas and electricity have advantages in industry in competition with fuels that are cheaper per unit of heat; they facilitate a constant quality of output, ease of control, cleanliness, and reduction of waste products. In claiming these advantages for gas we think Sir David was right to depart from a consideration of strict thermal efficiency (even the important question of difference between delivered and applied heat units), since there may be many other factors, both commercial and social, that will decide the means to be adopted for obtaining heat in industry and in the home.

The paramount importance of such factors will effectively prevent, within any period with which we need concern ourselves, any co-operation between electricity and gas that would lead to any limitation in the activities of either in regard to detail applications. A limitation of this kind has had unfortunate results in some instances in the U.S.A., in which the development of electric cooking has not been encouraged by the supply authorities concerned. This policy has deprived the public of a boon which, in Great Britain, it is rapidly coming to appreciate, as is indicated by the fact, mentioned in our "Correspondence" columns recently, that 75 per cent. of the electric cookers installed in Great Britain are in homes in which the whole work devolves on one woman. We therefore see no reason to deviate from the views on "The Limits of Co-operation" expressed in our leading article of last year to which we refer above.

Hire-Purchase.

We have received a prospectus of a company that has been registered to establish a hire-purchase clearing house where information respecting hirers will be filed, or by which it will be collected, so that members of the Clearing House organisation can ascertain whether a proposed hirer has anything against him, such as downright fraud, or whether with innocent intentions he lacks stability because he incurs liabilities beyond his means or prospects. There is an annual subscription and so many reports are furnished for a specified fee. The company, which last week invited the public to take up 37,000 shares of £1 each, states in its prospectus that there were in the United Kingdom upwards of 60,000 traders supplying goods upon hire-purchase terms. The company will establish the Clearing House mentioned above for the convenience of such traders, as they are satisfied of the need for such an institution. It is estimated that there are 6,000,000 members of the British public who have availed themselves in some form or other of the hire-purchase system. An up-to-date record of names will be maintained, and premises will be acquired in London where the necessary staff and equipment and filing system will be established. We are not mentioning these details to enlist investment in the concern, but to let our readers know of the existence of new measures that are being taken to prepare for the anticipated increase in hire-purchase business—a matter in which the electrical industry is interested.

The evidence given at an inquiry recently held in Glasgow by a committee appointed by the Secretary of State for Scotland to investigate the position of the hire-trading system in Scotland, showed how necessary it is for traders who employ the system to make sure of the standing of their customers. On the other hand, we feel that great care should be exercised in ascertaining their ability to pay; any suspicion of inquisitorial methods, giving the would-be customer a feeling that he is being "shadowed" as though he were a criminal, is to be deprecated strongly, both from the customer's own point of view and because it will tend to bring the system into bad odour.

The O.L.A.

Mr. W. C. Bexon, the new president of the Overhead Lines Association, in his inaugural address (from which extracts are given on a later page) made what we consider a sound suggestion in advocating the formulation of an O.L.A. standard specification for overhead lines.

An investigation ought certainly to be made into the discrepancies in the capital cost of construction, which, as Mr. Bexon showed, are considerable for lines apparently designed for similar duties. He referred to the willingness of the Electricity Commissioners to amend the Regulations if supplied with the necessary data in justification. The membership of the Association is increasing at a satisfactory rate and is now 205, but it behoves all engineers interested in overhead work to assist its development by bringing into the Association the benefit of their experience and of their recommendations for standardising construction and so effecting a reduction in capital costs.

Electrical Christmas Gifts.

All hope that we might yet get a little of the summer weather which failed to arrive in due season this year is dispersed by the arrival of the customary reminders that Christmas will be upon us in about eight weeks' time.

The slogan "Do your Christmas Shopping Early!" is being displayed already and it may now fairly be classed with the Christmas "annuals" in prematurity. But while it is really too soon to spring Christmas upon the public, it is time that electrical traders' plans were laid for the season's activities, and in this matter they should avail themselves of the service offered by E.D.A. as set out in the Association's November programme. We need not stress the supreme suitability of electrical presents for all occasions, the wide choice which they offer, or their happy knack of combining utility with attractiveness, but electrical traders should lose no opportunity of implanting these points in the minds of a public already receptive to electrical ideas, and they should now order the necessary stocks.

Modern Lighting—II.*

Tendencies in Continental design as illustrated by examples of recent achievements in Germany, where close collaboration obtains between the electrical engineer and the architect.

By A. B. READ, A.R.C.A.

To describe all the important examples of interesting lighting would be impossible in these articles, as every day a fresh addition is made to what is already a very long list. The few that the writer mentions are those which he was fortunate enough to see during short visits to Hamburg, Berlin, and Stuttgart, and are possibly relatively unimportant to outstanding modern schemes existing in other German cities. Therefore, those mentioned are not necessarily the most important or, for that matter, the most successful, but simply those which attracted his attention.

Fig. 8.—Curious Lighting in Restaurant Hans Sachs-Haus.

The Kino Universum, Berlin, already mentioned, has been praised by architects the world over for its boldness and breadth of treatment. In the same category is the Capitol, another kinema at the other end of the Kurfurstendam. The architect, Hans Poelzig, has not had the same opportunity for outward expression, as the kinema forms part of a block of buildings, but the interior has been praised by some of our prominent architects for the simple effects obtained from attractive lighting, with little decoration. The facetted sloping ceiling in a golden brown is lighted by lamps concealed in the cornice, while the proscenium opening is flanked by very decorative pilaster fittings reaching the full height of the opening. In this instance, as in the Universum, the severity of treatment might not appeal to the general public in this country, but one feels that in the German examples lies the nucleus of a style whose essence is fine proportion, lighting, and simplicity of decoration, and that slowly, but surely, our architecture will benefit by these examples of unencumbered design.

Unfortunately, in our own country buildings are still designed in the Roman style, or theatre foyers are still proudly described as being pure Egyptian; and this in an age of enlightenment when smart coupés have a character of their own, and when aeroplane designers think of purpose and function, and not of pigeons or peacocks. To those to whom the banalities of repetition of period styles are so nauseating, the freedom and vigour of German designers is as invigorating as fresh cool air after one has been in a rather stuffy room. For good or ill the mind of Germany is alive and expressing itself boldly, and from this truthfulness of expression good results are bound to come.

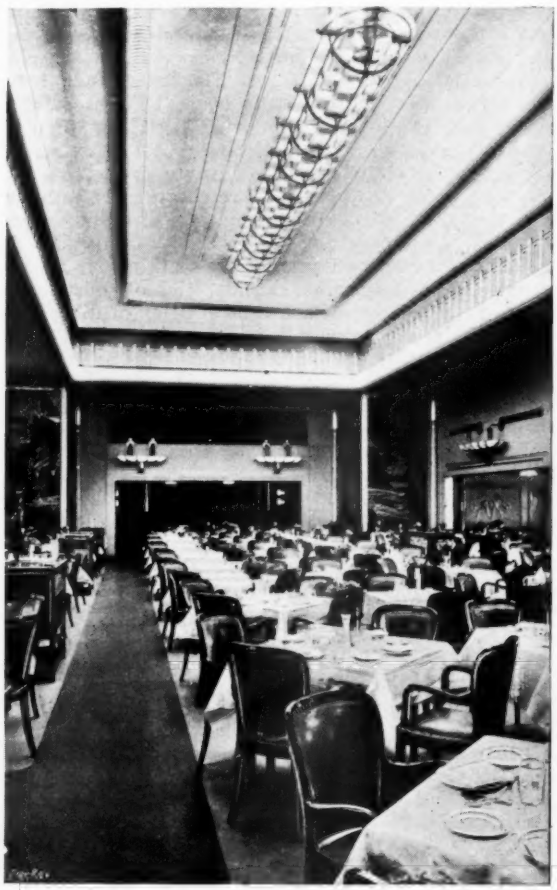
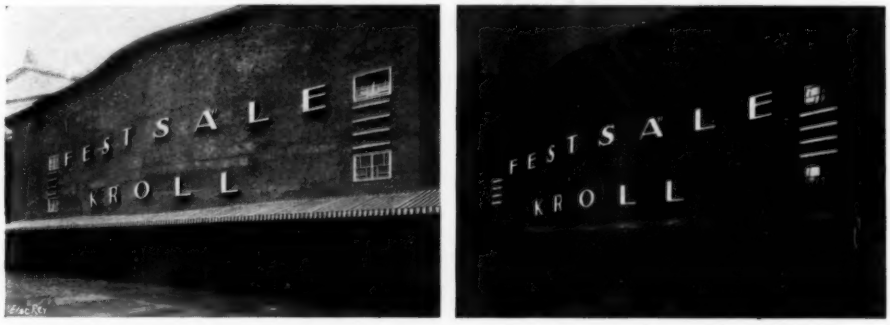


Fig. 9.—Tubular Lighting on s.s. "Bremen."

* For Part I, see October 24th issue.

Further from the west end of Berlin is the Titania Palast, perhaps the most spectacular example of kinema architecture in Europe. Horizontal panels of glass are built into the towers of this kinema to form at night



Figs. 10 and 11.—The Influence of Lettering on the Artist's Design; a well-designed Fascia by Day and Night.

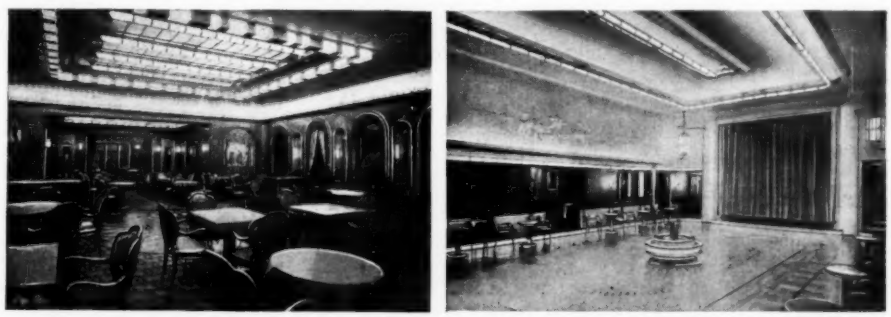
bands of light which, though large in size and brightly illuminated, provide a simple and dignified means of calling the attention of the public to its existence. Here, again, the style is pure, and the architect has presumably designed a modern kinema, not a hybrid pseudo-classic front with its hackneyed details obliterated by rambling illuminated signs and film advertisements. The interior, fig. 16, with its swirling lines and concealed lighting, is perhaps a little restless, but nevertheless it is proof of the courage of its designer.

In case, after the foregoing examples, one should suppose that pleasing detail and charm are being side-tracked by large plain surfaces and severity, one needs to visit such theatres as the Komedie and the Kroll Opera and Restaurant, figs. 10 and 11. The architect of those delightful buildings, Oskar Kaufman, must enjoy his problems and solves them with amazing skill. The Komedie Theatre, both by its elevation and its interior, appealed tremendously to the writer, as all the detail, though more traditional, had a freshness and daintiness that are difficult to describe. The Kroll Restaurant, with its great open-air enclosure and bandstand, must be an ideal spot in spring and early summer in which to lose one's cares. Unfortunately the writer's visit was too early in the year to allow of a meal there in the open, but fresh coats of paint on all the chairs and tables spoke of sunny days and the happy crowds that were to come to that perfect spot. The indoor restaurants of all classes at the Kroll are each in their way full of charm, especially in their methods of concealed lighting and the gay original lighting fittings in the huge ballroom.

In the long Kurfurstendam are shops, restaurants, and cafés, many of which are of interest, especially in the matter of general arrangement, display, and, above all, lighting. One especially, the Uhlandeck, has neon lighting radiating lines on a gilded shell-shaped ceiling as a means of illumination and decoration combined. This is the first example that the writer has seen of this form of lighting being used in an interior for this purpose, and the effect of the pinkish white light and its reflection from the gold leaf flutings of the ceiling is extremely pleasing and without glare.

To one interested in lighting practice and good design generally, matters that impress one more perhaps than any other in Germany are the very orderliness of signs of all kinds and the neatness and high standard of the lettering of shop names. In the most common and perhaps most successful and legible form, the letters are made up of opal glass fronts and returns with narrow metal angle framing. The opal glass is sufficiently opaque to screen the positions of the lamps and presents an evenly lighted surface which can be read from a considerable distance. Incidentally, the smooth surface of the glass is quite easy to clean. Instead of each shop competing with its neighbour with projecting signs and flickering lights of every conceivable kind, there is a uniformity which adds dignity to rows of shops, a quality that is conspicuously absent in London. The example illustrated in figs. 12 and 13, indicates the day and night effects of this type of lettering. If we acknowledge the necessity for illuminated advertising or display, we should profit by Germany's tidiness in this

Figs. 12 and 13.—A Dignified Building by Day and Night; Neon Lighting and Glass-box Lettering.



Figs. 14 and 15.—Decorative Lighting Effects in Restaurant and Ballroom of s.s. "Bremen."

field, as her architects certainly incorporate possibilities for this purpose when designing their facades. Too often have we seen huge signs with colossal letters straddling over windows and architectural features, spoiling well proportioned buildings and equally spoiling their own effectiveness.

Where names of firms or display signs are sure to be needed, special surfaces are left expressly for this purpose, and the utmost value is made of both the day and night effects of the announcements. Illustrations of these examples are not necessarily the perfect solution of this problem, but they are certainly an effort to face a modern problem squarely and save this form of publicity from being the abomination that it generally is.

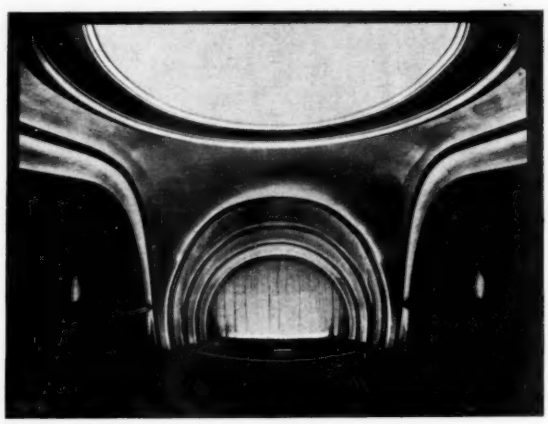


Fig. 16.—Concealed Lighting in Titania Palast.

Early in this series of articles special mention was made of the way in which the purpose of the building should give form and detail to the architecture and general arrangement and equipment. The writer is of the opinion that this should be the fundamental of any sound scheme, yet shipping companies still adhere to period and "hotel period" decoration and furnishing for their big liners. Possibly the majority of the wealthy patrons of these floating palaces feel more at home when surrounded by all the sham and tortured decorations of the hotels from which they have come, but there must be some who prefer the efficiency and character of ships like the new North German Lloyd *Bremen* (figs. 9, 14, and 15). Lighting forms a prominent decorative feature of this liner, from the small bunk lights to the continuous alabaster cornice lighting of the first-class dining hall and the huge ceiling fitting in the ballroom.

The illustrations give very little idea of the true lighting effect, but at every turn one is impressed by the neat tubular wall brackets, corner lights, and large decorative lighting fixtures of this modern, efficient ship. Certainly for its purpose this contemporary treatment seems more sane than the repetition of dreary period dining-rooms and Louis XVI cabins. Let us hope that our generation is sufficiently enlightened to keep the period decorators from experimenting on our air liners and airships.

All advance has met with the fiercest opposition from those rooted in their old methods and practices. There is the beginning of a great style in the efforts of courageous architects of the present day, and their success will depend very greatly on the help and advice of the electrical engineer and those capable of giving electric lighting the variety of presentation which it demands. Nowhere is this more apparent than in Germany, and the importance of lighting in all the most interesting architectural schemes implies the recognition that has been given to its immense possibilities.

Photo-electric Cells.

An Account of Some of their Industrial Applications.

By T. THORNE BAKER, A.M.I.E.E., F.Inst.P.

A DECADE and a half ago the development of the Fleming rectifying valve brought about a revolution in wireless telephony, the magnitude of which only those associated with the early attempts at radio speech can appreciate. Something of a very similar nature is taking place just now in all those arts involving the sensitiveness to light of chemical substances.

The sensitiveness of certain forms of selenium to light has long been known, and immense effort has been made to utilise this properly. Selenium cells have, indeed, proved of considerable utility, and they may yet find extensive applications; but it is the photo-electric cell which is responsible for the recent advances in picture telegraphy, in talking pictures or sound films, and in many ingenious technical applications to which reference will be made presently.

The photo-electric cell itself owes these important developments to the thermionic valve, for the original type of vacuum cell gave currents of the order of 10^{-10} ampere only on illumination, so that only by considerable amplification could its light sensitivity be turned to practical account.

The photo cell may be traced back for its origin to the discovery made by Hallwachs in 1888, that a negatively-charged body will lose its charge if subjected to ultra-violet light. A year later, Elster and Geitel discovered that the photo-electric emission was exhibited by electro-positive metals such as sodium, potassium, and rubidium, especially the latter.

Certain substances and elements show far greater photo-electric effects than others, and those in use in the modern cells are to some degree affected by the wavelength of the light that excites them.

A simple form of photo cell which we may consider is shown in fig. 1. Without going into specific details of the actual manufacture, it may be stated that the inside wall of the glass or quartz bulb, indicated by the shaded portion, is first coated with silver, and on this coating is deposited by distillation one of the photo-sensitive metals such as potassium, sodium, &c. An unsilvered portion, often termed the "window," is left as plain glass, and it is through this aperture that the light is directed on to the photo-electric coating. The alkali metal (potassium, &c.) is made considerably more sensitive by filling the cell with hydrogen at a few millimetres' pressure, and then passing a discharge through it, the metal being used as the cathode. This has the effect of converting the metal into a hydride. The emission for a given strength of illumination is greatly increased by this treatment, and the maximum sensitivity tends to shift somewhat towards the red end of the spectrum. The colour-sensitive maximum of the cell will also depend on the particular element of which the cathode is made.

A point of the highest importance in photometry is the fact that if the alkali metals are deposited on other metals, instead of on the glass walls of the cell, the electron emission may be excited by quite different regions of the spectrum. Thus, while potassium *on potassium*, *i.e.*, a thick layer of potassium, has its maximum sensitivity in the violet and ultra-violet, potassium on copper has a distinct maximum in the orange-red at about 6,000 A.U. The ordinary cell is,

in fact, like the ordinary photographic plate, "colour blind," or predominantly sensitive to violet and ultra-violet, but by the use of alkali metals deposited on cathodes of other metals it can be made to some extent colour sensitive. By combining photo cells sensitive to different regions of the spectrum it is possible to integrate the effects and thereby to photometer the white light of incandescent electric lamps.

Ives and Olpin have recently produced cathodes of caseium-oxide-silver, with traces of sulphur and oxygen, which give cells two maxima of sensitivity in the ultra-violet and red, and fair sensitivity throughout the spectrum. Organic dyes, such as are used in sensitising photographic emulsions—alazarine blue, for example—have also been found recently to increase the sensitivity for such wave-lengths as the dyed cathode absorbs. Case has produced barium cathodes with a

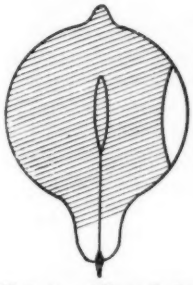


Fig. 1.—Glass-bulb Photo-electric Cell.

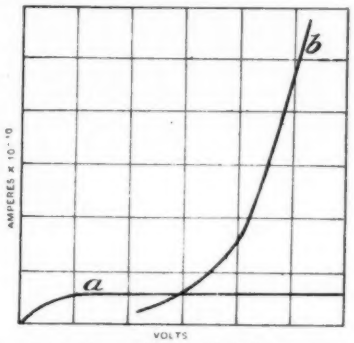


Fig. 2.—Effect of Voltage on Output; (a) Vacuum Cell (b) Gasfilled Cell.

well-defined maximum of sensitivity in the greenish-yellow. In sound film technique red sensitivity is of great importance, owing to the spectral energy distribution of gasfilled lamps, and in this connection the "Mazda" thin-film caseium cell of Davies and Ruff deserves special notice.

We have still further to differentiate between the vacuum and the gasfilled cells. In the latter, a trace of an inert gas, *e.g.*, argon, is introduced, and the primary photo-electric current is thereby greatly increased, owing to further (secondary) ionisation by the collision of the original electrons with the gas molecules.

While the vacuum cell gives a higher output the higher the voltage applied, the gasfilled cell demands consideration of a third factor—the gas pressure. The

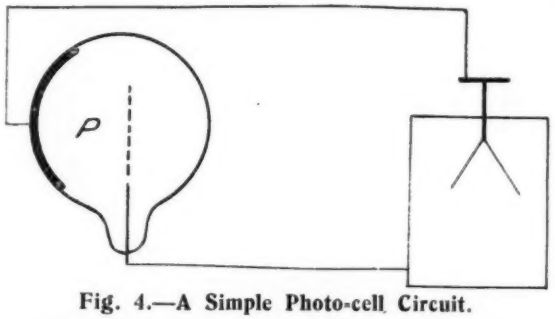


Fig. 4.—A Simple Photo-cell Circuit.

optimum voltage will vary with the pressure, but the latter may vary round a millimetre or so. Fig. 2 shows the effect of voltage on the output of (*a*) a vacuum cell and (*b*) a gasfilled cell, while fig. 3 is a typical series of curves showing the effect of gas pressure on output in microamperes per lumen of light.

Recent cells of the vacuum type evolved by Koller and Thomson have given as much as 25 microamperes per lumen.

It may be imagined from (*b*) that the output of the cell could be increased indefinitely by increasing the applied voltage, but a limit is set by the "glow discharge," a purplish glow set up in the gas when the current rises suddenly by excess electrons and continues to flow, whether the cell be illuminated or not.

If the voltage be decreased to five or ten volts below the glow-discharge pressure, the cell will be in its most sensitive condition. The greatest voltage that can be applied is that just below the glow potential for the most powerful light that is to be measured by the cell. To protect the cell from damage by the glow discharge, a resistance of not less than 10,000 ohms is usually placed in series with it.

Vacuum cells give a primary current strictly proportional to the amount of light falling on the cathode, this ratio being termed the *emission;* but gasfilled cells, being so very much more sensitive, are used in most industrial work other than photometry. The velocity

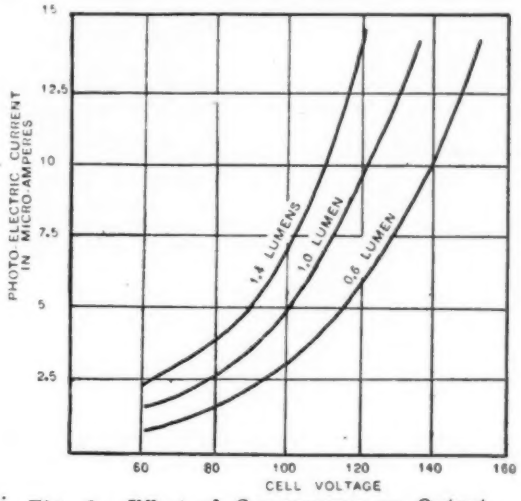


Fig. 3.—Effect of Gas-pressure on Output.

of emission of the electrons is independent of the intensity of the illumination, but the number emitted is directly proportional to it.

Some idea of the output of the gasfilled cell may be gathered from the fact that, in the radio transmission of photographs, three-stage amplification of the photo-cell current caused by the light of a 100-watt "Pointolite" lamp after traversing the picture will suffice to operate a Post Office-pattern relay requiring 12 to 15 milliamperes.

For the accurate measurement or comparison of light sources the vacuum cell is in general to be preferred, provided sufficient light be available; but for such purposes as actuating a relay *by light*, *i.e.*, not by any particular amount of light, the gasfilled cell is far more practical. The recently-introduced glow relay of Isenthal, which gives extraordinary amplification,

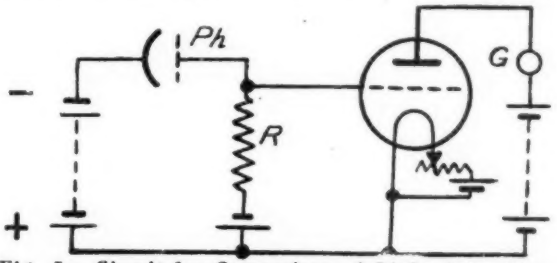


Fig. 5.—Circuit for Comparison of Light Intensities.

makes the magnification of the photo-electric current very simple. This relay operates with an impulse current of 10^{-10} ampere, and when discharging passes as much as 30 milliamperes.

We may now perhaps refer briefly to some of the applications of photo-cells. The simplest possible circuit is that shown in fig. 4, where P represents the cell, the cathode of which is connected to an electroscope, the anode being earthed. If the electroscope be charged, and the leaves diverged, the rate of collapse of the leaves will be inversely proportional to the intensity of the light falling on the cell. Another simple circuit, suitable for comparing light intensities with relative reflecting power, &c., is seen in fig. 5.

(To be concluded.)

Rating of Supply Undertakings.

Important Proposals for Remedying the Existing Unsatisfactory Conditions.

By H. T. SEYMOUR, F.R.Econ.S., A.C.I.S., etc.
(*Chartered Secretary and Certified Accountant*).

THE annual report* submitted to the Minister of Health on the proceedings of the Central Valuation Committee during the year ended March 31st, 1930, is of particular importance to all public utility undertakings in view of the inclusion of an abridged report of a conference with associations representing electricity, gas and water interests, which took place in February last with the object of more closely ascertaining the difficulties which such undertakings experience in connection with valuations for rating purposes.

As a result of the conference, a small Sub-Committee was set up to consider the whole question.

The Sub-Committee is composed of the following members :—

Mr. Trevelyan Lee (chairman), Mr. E. Austin, Sir James Slade, J.P., F.S.I., Col. Spain, F.S.I., F.R.I.B.A., Mr. A. W. Balmer, Mr. E. Knox, J.P., and Mr. H. O. Syrett.

This Sub-Committee met once during the year under review, and it is considered that it will be engaged for some time to come on the many important problems involved. The final recommendations will be awaited with great interest as the contribution of the public utility services in Great Britain to the local exchequers, in the form of rates, probably exceeds £9,000,000 annually.

The Associations represented at the Conference included the following :—

Association of Electric Power Companies.
Conference of Chief Officials of London Electric Supply Companies.
Incorporated Municipal Electrical Association.
Provincial Electric Supply Association.

A memorandum dealing with the various points suggested for discussion had been previously prepared and submitted to the Central Valuation Committee; these matters are set out below :—

" (*a*) The provisions of the Rating and Valuation Act, 1925, requiring certain returns to be made by occupiers and the absence of any provisions in the Act of 1925 as to the particulars to be furnished by Public Utility Undertakers to Rating Authorities and by Rating Authorities to Public Utility Undertakers in arriving at the valuation of a Public Utility Undertaking."

" (*b*) It is suggested that it will be of advantage to consider whether Rating Authorities should furnish Public Utility Undertakers with the details upon which the valuation of the Undertaking has been made and also to consider what recommendation should be made by the Central Valuation Committee to Rating Authorities as to the particulars which should be furnished by Public Utility Undertakers to Rating Authorities and *vice versa*."

" (*c*) The difficulty which arises in the valuation of Public Utility Undertakings where the hereditaments of the Undertaking are contained within more than one rating area or in more than one county. In some districts steps have been taken to induce Rating Authorities to appoint one or more valuers to represent the Rating Authorities and value the undertaking as a whole; in certain other districts Rating Authorities have assessed the hereditaments in their area without having regard to the undertaking as a whole. It is suggested that steps should be taken to secure uniformity so that the undertaking shall be valued as a whole in every case."

" (*d*) The absence of a recognised method upon which the rateable value of a Public Utility Undertaking can be apportioned."

" (*e*) The difficulty arising out of Section 19 of the Act of 1925 which provides that Valuation Lists shall come into force on April 1st, 1928, and April 1st, 1929, and subsequent valuations be made at intervals of five years."

" (*f*) The making of proposals for the amendment of valuations of Public Utility Undertakings within the quinquennial period. New hereditaments may be directly or indirectly productive and may, and, indeed, usually do, include works which are of greater capacity than is required for immediate needs. No such proposal should be made on works which do not become remunerative within the quinquennial period. As in quinquennial so in intermediate valuations, it is desirable to consider the particulars which should be furnished by Rating Authorities and Public Utility Undertakers, respectively. The same suggestion is made with regard to 'supplemental valuations' where these still obtain."

" (*g*) The legal difficulty which prevents a municipal trading department objecting to an assessment made by the Rating Authority of which it forms a part."

The first item arises out of the distinctive " profits principle " of assessment (based on " case law " and confirmed in Kingston Union Assessment Committee *v.* Metropolitan Water Board (1926)), applicable to public utility undertakings and the absence of any specific statutory provisions as to the method to be adopted in carrying out this principle.

It will be remembered that the Rating and Valuation Bill as originally drafted provided for the valuation of such " special properties " to be made by the Railway Assessment Committee under the direction of a Central Valuation Authority, but the necessary legislation has not yet been passed to authorise the valuation by a Central Authority.

The representatives of the gas and electricity interests stated that they took the view that it would be of assistance if the Committee could give some guidance to Rating and Valuation Authorities in respect of the particulars required, and that the Associations concerned would be very ready to discuss with the Committee the form of return. They believed that a good deal of time, and perhaps expense, would be saved if some mutual arrangement could be come to with the assistance of the Committee.

Regarding paragraph (*b*) it was explained that it would be of advantage if public utility undertakers could obtain particulars of the assessment. The Associations concerned hoped that in course of time there would be some agreed form upon which the particulars would be set out, and that some information would be given to undertakers as to the basis upon which the valuation had been built up.

Although undertakings are entitled to have their properties valued as a whole it was pointed out that the Associations represented did not believe that this was so widely appreciated as it should be, and they asked for the assistance of the Committee in making it a general practice.

The question of the apportionment of the rateable value of an undertaking was next referred to, and it was suggested that while the actual apportionment was a matter essentially for the various rating authorities, it would be decidedly helpful for the basis to be outlined, as such knowledge would assist the valuation. It was further stated that there was no one definitely recognised method of apportionment, and that it was desirable that such a method should be laid down and given official sanction.

It was stated that the operation of Section 19 of the Rating and Valuation Act, 1925, was a point of some difficulty in the case of the larger public utility undertakings. While it was appreciated that the spreading of the work of valuation over a period was desirable,

* Not yet published by H.M. Stationery Office; obtainable from the Ministry of Health.

it was emphasised that in the case of undertakings covering large areas of supply a frequent result of Section 18 was that more than one valuation would be required in a quinquennial period; with the consequence that there was not, in such cases, an agreed valuation for the whole of the hereditament at any one date.

Special reference was made by the gas interests to the circumstances of a company which extends into no fewer than 44 different areas. Forty-four separate assessments had to be agreed upon in due course before the various Assessment Committees, and in 1925 the company underwent the usual quinquennial re-valuation in connection with the London area. A year or two after the London quinquennial re-valuation, the company was involved in the re-assessment of the portion of its area (extending from Windsor almost to Southend) covered by the 1925 Act. A valuation had to be prepared based on the accounts of the year 1927 as they were the latest accounts out at that time. The proceedings were very protracted, and before the hearing was taken the accounts for the year 1928 had been published, with the result that the valuers for the other side brought forward their valuations based on the 1928 accounts, and as a consequence the company had to follow suit. The company was now faced with the London quinquennial valuation once again and it would have to make a valuation on the 1929 accounts, and as soon as that was over it would be faced again, probably, with a further valuation under the 1925 Act, in 1932 or 1933. It would be seen that at no time recently had it been possible to say what the total assessment of the company had been.

With regard to paragraph (*f*) this was regarded as being of particular importance at the present time in view of the fact that in many cases Public Utility Undertakings were making extensions, with the assistance of Government grants, to relieve unemployment. These extensions were made with the full knowledge that for many years they would not be productive, but they were made primarily for the purpose of finding employment and in anticipation of future needs. If it could be emphasised and some broad principle applied that, where it could be shown that these works were not productive or likely to be productive for some considerable time, the undertakings should not be put to the expense of a re-valuation, it would be of great assistance.

The anomalous position of the trading undertakings of local authorities, as compared with similar undertakings carried on by private enterprise, is referred to in paragraph (*g*) and it is to be desired that some way of surmounting this legal difficulty will be found.

In the case of composite undertakings (*e.g.*, electricity and water) the view was expressed that it was desirable that a separate valuation should be made of each part.

The chairman of the Conference (Sir James Curtis, K.B.E., J.P., vice-chairman of the Central Valuation Committee) said, in concluding the meeting, he assumed that most of the representatives present were aware that the Central Valuation Committee had realised at the outset that some difficulties might arise under the new Act in connection with Public Utility Undertakings, and it had passed the following resolutions:—

No. 28 (*a*), First Series of Representations.

"That, in the view of this Committee, it is desirable, in the interests of uniformity, that the valuation of all the special properties of any particular class which are referred to professional valuers should be made, in the first instance, by, or under the supervision of, one professional valuer over as wide an area as possible."

No. 38 (*b*), Second Series of Representations.

"That it is important in the highest degree that, where more than one valuer is employed to value an extensive hereditament, the valuers should, on behalf of the several Rating Authorities, agree upon a common basis of valuation and where the apportionment of a total value among the several rating areas is necessary, should also agree upon the basis of apportionment."

It was obvious, he said, from what had been stated, that the Committee's recommendations in this respect had not been universally adopted by rating authorities. It would be realised, however, that the Committee was only an advisory body, without power to do anything except make representations to the Minister of Health. The Committee had decided to appoint a special Sub-Committee with wide terms of reference to consider and report upon all the points which had been raised with regard to the valuation for rating purposes of public utility undertakings. The chairman promised that it would be a special instruction to that Sub-Committee to work in the closest co-operation with the Public Utility Associations generally and particularly with those represented on that occasion.

The result of these deliberations will, it is suggested, be eagerly looked for by the officials of Public Utility Undertakings and others concerned in the valuation of such "special properties."

A New Traffic Signal.

Particulars of a new electrically-operated road signal shortly to be introduced to the market, for which simplicity is claimed.

By F. G. H. MACRAE.

THE signal described in this article consists of a cast-iron centre column which carries (*a*) a heavy dial with a steel arm near the periphery, (*b*) a rocking lever with an armature at each end, (*c*) brackets carrying the electro-magnets, and (*d*) a two-way change-over switch. The whole is enclosed in a metal case 33 inches in diameter and 9 inches in thickness.

The dial D (see fig. 1), with the arm A and the rocking lever R, are mounted on the centre column concentrically, and the brackets carrying the electro-magnets M are mounted beneath, so that when one armature rests on one electro-magnet the other armature leaves a gap of about 1 inch at the other electro-magnet.

The steel arm A on the dial is arranged to come to rest on either armature, and in changing position from one to another rotates through 180 degrees.

Below the brackets carrying the electro-magnets M is mounted the change-over switch S, which is operated by knock-outs K fixed to the periphery of the dial. When a current is passed through the electro-magnet, which has a gap between it and the armature, the armature closes slowly at first, then with a powerful snap. This causes the other armature upon which the arm of the dial rests to move upwards, and so starts the dial in motion. Although the armature only moves through a small distance, it does so under considerable force, so that the energy available is quite large. The dial, however, can be given only a small velocity in such a short distance, but, by making the dial heavy, this energy can be absorbed like a flywheel, which will then continue to rotate until the arm reaches the other electro-magnet. As the rocking lever moves through

6 deg., and the dial through 180 deg., the gearing is 1 to 30, without any form of mechanical gear. When the arm reaches the other armature, the energy in the dial is the same as at the start, except for frictional

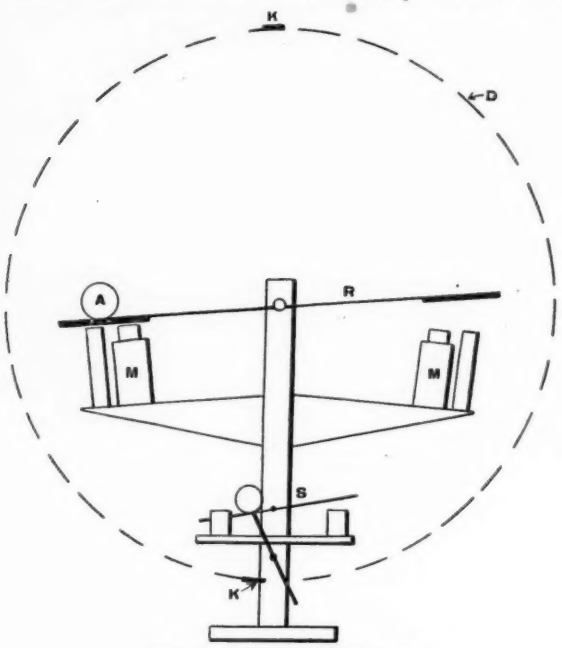


Fig. 1.—Details of Signal.

loss, which is small, owing to the dial being mounted on a ball bearing. In order to bring the dial to rest dead beat, this energy has to be got rid of, so part of it is used to operate the switch, and the remainder is absorbed by the magnetic hold of the steel arm to the excited armature. In order that the current may remain on long enough for the magnetic hold-down, the switch is arranged with a delay action.

When the arm reaches the armature, the knock-out on the edge of the dial has raised the weighted knock-out lever to its mid-position: this weight operates under its own inertia, and knocks the rocking switch arm out of one contact into the other, so closing the circuit for

Figs. 2 and 3.—Alternative Indications of Dial.

the other electro-magnet to be excited, when the action is repeated in the opposite direction.

One half of the dial face is covered by a plate, which permits of the two halves of the dial itself to be exposed in turn (figs. 2 and 3).

It is claimed that the simplicity of operation reduces the chance of failure to a minimum, and tests have shown that the signal works effectively, even when tilted 30 deg. from the vertical.

A New Cable.

The author claims to have solved the operation difficulties associated with very-high-pressure cables, without adding appreciably to the cost of manufacture.

By THOMAS HARDEN.

A NEW method of reinforcing the soft-lead sheathing of power cables has been devised by the author as a means of preventing, to a great extent, the expansion of the lead sheath when it is subjected to electrical and mechanical stresses, and of ensuring its contraction to its original dimensions with the return to normal conditions.

Lead is the only metal that can be used for the sheathing of cables; owing to its ductility, its characteristics are more like those of a liquid of extreme viscosity than those of a metal, it being deformed under very slight pressure. To overcome this weakness, a system has been patented, under the title of "Reinforced Lead Covering of Cables," No. 326,684/30.4. The reinforcement of the lead is effected by means of a non-ferrous tape, about 0.002 in. thick, lap wound over the exterior of the insulation. One half (width) only of the surface of the tape is tinned, and the other half acts in a similar manner to that of a metallic hose, allowing for bending during the various operations in manufacture, transport, and laying.

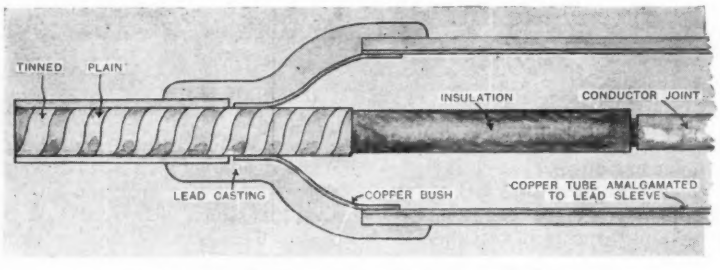


Fig. 1.—Proposed Joint for New Cable.

In the manufacture of the cable, during its passage through the lead press, an amalgamation is effected between the tinned surface of the non-ferrous tape and the interior of the lead sheathing, leaving the untinned portion of the tape free to move. In this way an internally-armoured cable is obtained that governs the expansion and contraction of the lead in the manner described above, thus preventing voids in which ionisation effects can be set up. The construction of the cable is depicted in fig. 2.

The impossibility of armouring a super-pressure cable

in the ordinary way with iron or steel tape or wire has resulted in the use of non-ferrous tape spirally wound over the lead sheath protecting the insulation, and the application of a second lead sheathing overall. By the invention which is the subject of this article it is not necessary to use such a heavy gauge of non-ferrous tape, and the second lead sheathing is dispensed with, thereby considerably reducing the cost of manufacture, and forming a more mechanical method of protection by turning the weak lead into a practically stable metal. At the same time, the tape acts as an earth shield, greatly increasing the safety factor of the cable which may, therefore, be laid direct in the ground.

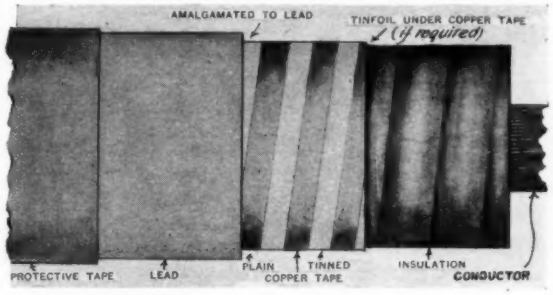


Fig. 2.—Construction of " Harden " Cable.

The patent granted to the writer also covers the construction of sleeves used for jointing the cable. A lead-coated copper sleeve, fig. 1. is employed and connected to the cable sheath at each end by a metal casting effected by means of a mould introduced by the inventor some years ago, thus dispensing with wiped joints, but ensuring continuity of the internal armouring and preventing the collapse often associated with ordinary lead sleeves.

Apart from the use of this system for super-pressure work, the risk of installing cables in subways and enclosed spaces in contact with or near gas mains is overcome by the use of the internal armouring or earthing shield. Another important point is that, owing to the amalgamation of the lead with the copper, the lead is held rigidly, so that crystallisation troubles due to vibration are overcome.

The merit of the invention lies chiefly in its simplicity; there is merely a lap winding of thin non-ferrous tape interposed between the insulation and automatically amalgamated to the lead. The additional sheathing in no way interferes with the electrical properties of the cable, and its introduction entails very little alteration to existing cable-manufacturing equipment.

Electricity for the Home.

Selections from Recently Introduced Manufacturers' Items.

Glass-ware Lighting Fittings.

Messrs. Drake & Gorham Wholesale, Ltd., 77, Long Acre, W.C.2, have recently issued a catalogue illustrating lighting fittings which they are supplying. From this we have selected two or three fittings for comment. The first of these is a wall fitting strongly reminiscent of an episcopal mitre. It comprises two tinted-glass panels fitted into antique brass metal-work; it is 9 in. in width. A wall bracket of a very different character is shown in the second picture. This has an antique-brass framework backed by amber glass. It is enclosed at the bottom and finished off by a tassel. Among the pendants illustrated in the list is the ornate model shown in the third illustration. This is hexagonal in plan and is built up of " Amberlite " coloured glass panels in a tastefully-designed toned-bronze framework. Tassels to match are fixed at the angles. The overall diameter of the fitting is 16 in.

Figs. 1, 2 and 3.—Some Drake & Gorham (Wholesale) Fittings.

New Candle Appliances.

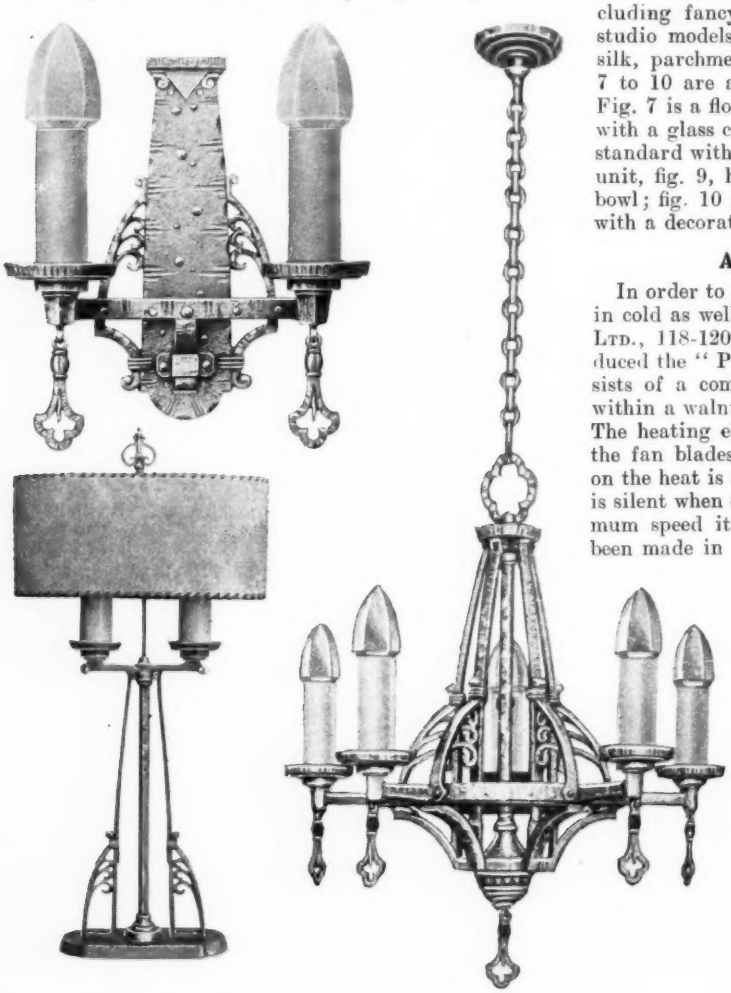
Old English bronze with old-silver colour enrichment governs a new range of " Emblique " lighting pendants, brackets, and table standards recently introduced by the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, many of which incorporate emblematic features of bold conception and pleasing execution. Another interesting point about this new range of candle-type fittings is the utilisation of standard-shaped " Osram " lamps in different colour finishes, and also a new-shaped lamp in what is known as the " Gothic " type, in flame or ivory colour, instead of the ordinary type of candle lamp. The " Gothic " lamp is octagonal in shape at the base of the bulb, finishing to a point. It is fitted with a standard bayonet cap, and is suitable for use in almost any fitting in which the light source is visible. At present it is made in the 25-W size only, for voltages from 100 to 130 and from 200 to 260. The pendants are mostly of the five-light type, while the brackets and standards are generally of the two-light variety, and, as will be seen from the accompanying illustrations, figs. 4, 5, and 6, they are finely fashioned and choicely finished throughout. A distinctive and pleasingly novel point about the range is the fact that different coloured lamps may be used to harmonise with widely-different furnishing schemes, or to provide seasonal or periodical lighting variations according to taste. Most of the new units are designed to accommodate 40-watt

lamps, although, of course, higher or lower wattages may be used if desired. The standard range of coloured lamps suitable for these new designs comprises red, orange, yellow, green, blue, flame tint and white in the sprayed variety, daylight blue, green, yellow, amber, ruby, and other tints in natural-coloured glass lamps, and, of course, the standard "Pearl Osram" lamps. In addition, there are the "Gothic"-pattern lamps previously referred to, so that there is a wide choice of lamps from which to make a selection. One important point is that all these lighting fixtures are designed to accommodate lamps with standard bayonet caps, so that replacing or changing over the lamps involves no trouble.

Figs. 7 to 10.—A Selection from the Range of "Monolamp" Fittings.

New Indirect Lighting Fittings.

A range of artistic indirect lighting fittings under the style of "Monolamp" has recently been introduced in this country by Messrs. Monolamp, Langham House, 308, Regent Street, W.1. The range embraces floor and table standards, suspension units, and vase models, all embodying the inverted-lighting principle, but at the same time permitting the decorative features of the lamp to be emphasised. This is effected by a special inverted silvered-glass reflector, designed for one 150-W lamp, which also allows a small downlight. The appliances are available in a variety of constructions and finishes, including fancy stands of popular woods and lacquers, studio models in bronzed-copper and nickel, and with silk, parchment and glassware shades or bowls. Figs. 7 to 10 are a representative selection from the range. Fig. 7 is a floor standard of polished and nickelled steel with a glass cup; fig. 8 is a brown varnished wood floor standard with a yellow silk empire shade; the suspension unit, fig. 9, has a decorated and varnished parchment bowl; fig. 10 shows a vase model in dark-green pottery with a decorative paper shade fitted with a silk knot.



Figs. 4, 5 and 6.—"Emblique" Bracket, Table, and Pendant Fittings.

A Hot- and Cold-air Diffuser.

In order to provide a means of diffusing air in a room in cold as well as hot weather, the Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.2, has introduced the "Primo" hot- and cold-air diffuser. It consists of a combination of a fan and heating elements within a walnut cabinet of pleasing appearance, fig. 11. The heating elements are mounted radially in front of the fan blades, so that when the elements are switched on the heat is diffused by the action of the fan. The fan is silent when operating at medium speeds, and at maximum speed it can scarcely be noticed. Provision has been made in an ingenious way for the air diffused by the fan to be either perfumed or disinfected. This is accomplished by placing in the small receptacle provided a wad of absorbent cotton wool which has been steeped

Fig. 11.—"Primo" Hot- and Cold-air Diffuser.

in the substance to be diffused. By means of a valve diaphragm the perfume can be cut off at will. To ladies the appliance will appeal for use as a hair dryer, eliminating the tiring effect of having to hold the apparatus. The six-speed regulator gives just the degree of air diffusing necessary, it is claimed, to keep one cool in summer and warm in winter. The fan loading is 70 W, and the combined fan and heater loading 740 W.

Fire for Tiled Surrounds.

A somewhat novel heating appliance is an electric fire which has been specially produced by Messrs. Walker, Hunter & Co., Ltd., Falkirk, for fitting into tiled surrounds. It is fitted with the "Walker" standard bar element for which is claimed long life and the maximum radiant effect possible. A feature is that cold air enters at the openings in the base of the fire and leaves through the upper grating in a warm stream, which quickly and uniformly heats the room. The heat control is effected by two switches fitted in the base of the fire. The front-plate dimensions are 24 in. high by 15 in. wide, and the fire projection at the back is 23 in. high by 12 in. wide by 2½ in. deep. The fire can be supplied in two loadings, 2,000 and 3,000 W.

The illustration, fig. 12, depicts a fire similar to that described, but fitted into a mantel register. Messrs. Walker supply registers which have been specially designed for use with either coal or electric fires. In the latter case the bottom grate and fret are removed and substituted by the specially designed "Walker" fire.

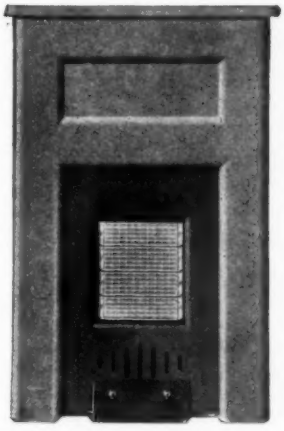


Fig. 12.—"Walker" Fire in Mantel Register.

The Institute of Fuel.

Extracts from the Presidential Address Delivered at the Annual Conference in London.

By SIR DAVID MILNE-WATSON.

THE Institute's membership has increased 35 per cent. in the past year. Two provincial sections have been established with meeting places at Manchester, Nottingham, Derby, and Bristol. The number of students is 90 and a students' section is to be formed.

The great extension of the use of gas all over the world was especially commented upon at the Berlin World Power Conference. By reason of the increasing mechanisation of industry and the greater use of power the sale of electricity is advancing rapidly, but it is not so generally appreciated that there is a concurrent desire for efficient means of heating, which has resulted in the sale of gas increasing at nearly twice the quantity of the electricity increase when referred to a common heating basis.

Several low-temperature processes are being operated in various parts of the country, and the successful treatment of coal at low temperatures is now understood. On the financial side, plant which can secure good slack at low prices and sell coke at good prices can show a profit; other plant at a distance from the coalfields cannot find sufficient margin to meet operating expenses. There is a market for low-temperature gas and coke, but the oils have proved disappointing in quality and value, as also has ammonia. The perfecting of cracking, or hydrogenation, processes to improve such oils is awaited. Until it can be achieved successfully on a commercial basis, and the consumer of smokeless fuel has to pay no more than his air-polluting neighbour, there is no hopeful future for any low-temperature process principally devised to make smokeless fuel. It is more probable that the smokeless fuel of the future will be prepared from selected, prepared, and blended coals by high-temperature processes. The proper organisation of the carbonising industries could produce 12 per cent. of the motor spirit and 25 per cent. of the other imported oils. It is necessary that the production of such oils be modified and controlled to produce the required properties.

The development of the national electricity scheme has directed public attention to this aspect of national fuel utilisation. There has been a creditable fall in the coal used per kWh generated; however, losses in generation and transmission resulted in the consumer receiving only 10 per cent. of the heat in the coal consumed last year. Where private power generation is as efficient as public generation, the transmission losses are eliminated. Where equal efficiency of generation is unattainable, it is desirable that privately-owned power plant should be replaced by supplies from the public mains. The experiment of carbonising coal before combustion at a power station is being continued. Several important power stations now mix coal breeze with their coal, and large quantities of coke breeze are so used in London. The salesman of to-day serving the gas industry has already to differentiate between gas, coke, and other forms of smokeless fuel, and it is not difficult to visualise an extension of his activities to electricity, which means that in future gas and electricity producers will tend to co-operate in the marketing of their wares, so as to give greater satisfaction to the consumer and to avoid business being secured at unremunerative prices. The proper uses of the various forms of prepared energy are generally so clearly defined that such co-operation presents no difficulty.

With reference to the development of hydro-electric power generation in Ireland and Scotland and to the Severn River tidal proposals, it must be pointed out that coal must remain the principal means for the generation of electricity in this country. Developments in other countries are dependent on their natural resources. There is no oil, brown coal, or natural gas in this country. To-day, as in the past, our success as a manufacturing nation must be based on coal. In 1929 the coal output was 20 million tons greater than in 1928, and the industry has shown evidence of improvement in the past two years. Progress has been made in the mechanisation of mines and the industry is approaching a favourable, if not prosperous, state. In the midst of this state of affairs the Government passed the Coal Bill for reasons of political expediency. It contains potentialities objectionable to the industry itself and to all fuel users, particularly gas, electricity, and railways, whose reactions were predetermined by Statute. Economic laws may prove superior to Acts of Parliament, and people might be driven to use oil and to reduce their consumption of coal.

Coal should be subjected to treatment before marketing; care in this direction had already enabled us to secure again foreign markets lost in competition with Polish coal. Heat, light, and power are such essential services in the home and in industry that any threatened increase in their cost must be accompanied by the keenest endeavour to counterbalance such an evil. It is necessary at the present time to produce a co-ordinated national fuel policy. Coal, and coal alone, must be the foundation of such a policy. Coal and its derivatives alone can secure the nation's prosperity. The cleaning, grading, and selection of coal varieties open the door to its sale by guaranteed specification. This form of purchase is growing, and the British Engineering Standards Association's specifications help the purchase of coal of standardised quality. The transport of energy in coal, whether as coal, gas, or electricity, needs examination to secure it at a minimum cost. A considered plan for the purpose of co-ordinating and extending the activities of the carbonising industries, with proper linkage to electricity development, is necessary.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

The Trade of the Philippines.

A recent report on economic conditions in the Philippine Islands prepared by Mr. T. Harrington, British Consul-General at Manila, has been published for the Department of Overseas Trade (Stationery Office, 1s. 6d. net). In the trade of this territory the United States is predominant, being responsible for about two-thirds of the imports and three-quarters of the exports. The United Kingdom's share of the import trade varies between 4 and 5 per cent., our share of the export trade being slightly higher. As regards the electrical trade, the Philippines' importation of electrical machinery and appliances in 1929 was valued at £761,547, as compared with £446,110 in 1928 and £501,412 in 1927. Imports of other electrical goods were valued at £161,767 in 1928 and £245,628 in 1927. In 1928 the United Kingdom supplied electrical machinery and apparatus worth £10,876 (£12,561 in 1927) and Germany provided £13,490 worth (against £11,966). The United States supplied electrical machinery, apparatus and appliances valued at £391,093 (against £442,570).

Stoke-on-Trent and Registered Contractors.

At a recent meeting of the Stoke-on-Trent Electricity Committee, the engineer reported upon the conditions under which wiring contractors were placed on the National Register of Electrical Installation Contractors, and after careful consideration it was decided that Corporation contracts for wiring installations should be given only to registered contractors.

A New Swiss Financing Company.

The formation at Basle is announced of the Continentale Elektricitäts Union, A.G., with an authorised capital of 20,000,000 Swiss francs, of which one half has already been taken up. The object is to undertake financial transactions and in particular the strengthening of the relations between Swiss banking circles and the North-West German Power Works, the United Saar Electricity Company and the Wehrden Power Station. Among the many participants are the Prussian (State) Electricity Co., J. Henry Schroeder & Co., of London, and New York interests.

Irish Free State Electrical Imports.

The subjoined table shows the value of the electrical machinery apparatus and cognate goods imported into the Irish Free State during the eight months ended with August last as compared with the corresponding period of 1929 :—

	January to August. 1929.	1930.
	£	£
Electrical machinery	226,113	201,918
Electric wires and cables	128,577	117,111
Electric lamps and parts	45,999	59,780
Wireless sets and parts	50,874	53,585
Other electrical goods	161,747	132,473
Copper wire	59,083	25,343
Totals	£672,393	£590,210

It will be seen that so far this year there has been a decline of £82,181 in the total imports, the only item showing an increase being radio apparatus.

Recent Contracts.

In contrast to the very small number of large electric winding plants that have been installed in this country during the past few years, it is interesting to note that important mining developments are taking place in other parts of the Empire. The Metropolitan-Vickers Electrical Co., Ltd., informs us that in the last few months it has received orders for eight Ward-Leonard equipments of considerable size, four for Australia and four for Rhodesia, involving nearly £120,000 worth of electrical equipment.

Reuter (Copenhagen) reports that Messrs. C. A. Parsons and Co., Ltd., have secured a contract to supply electrical plant for the Copenhagen Municipal Lighting Department to the value of £142,000.

The F.B.I. and Fiscal Policy.

Following upon its decision to press for the reform of the existing fiscal system (*vide* our last issue, p. 687), the Federation of British Industries has set up two committees. The first, representative of the leading trade associations, will consider the type of tariff which would best meet the demands of British industry and the best methods of aiming at reciprocal agreements with the Dominions. The second committee will formulate a complete industrial policy covering questions other than tariffs, *i.e.*, national economy, taxation, currency policy, &c., matters upon which the F.B.I. has expressed its views from time to time.

New Czecho-Slovakian Company.

Under the auspices of the Siemens & Halske Co., Berlin, a company has been formed in Prague with a capital of 12 million crowns and the title of the Elektrotechna Gesellschaft für Schwachstrom-Technik to manufacture l.p. electrical apparatus. Of the capital, 49 per cent. is being provided by the German company and 51 per cent. by Czecho-Slovakian banks.

Electrical Gifts for Christmas.

The General Electric Co., Ltd., is early in the field with some suggestions for appropriate electrical Christmas presents. They range from car heaters to lighting fittings and include such things as curling-tong heaters, radio sets, shaving pots and vacuum cleaners—a choice wide enough for all tastes and pockets.

New Australian Companies.

The following electrical companies have recently been registered in Australia :—E.R.G. Batteries, Ltd., 162, Goulburn Street, Sydney, N.S.W., capital £10,000; the Vita Storage Battery Co. (Australasia) Pty., Ltd., Temple Court, Collins Street, Melbourne, capital £50,000; and Aldawade Electrical Appliances (Australia) Pty., Ltd., 405, Collins Street, Melbourne, capital £10,000.

Great Britain's Radio Exports.

The *Wireless and Gramophone Trader* states that during August last the exports of radio apparatus from this country were valued at £71,597, including valves to the value of £23,236. The principal destinations of these goods were as follows : Australia, £13,883 (valves £4,126); France, £6,490 (valves £5,275); South Africa, £4,647 (valves £1,516); Poland, £3,466 (valves £1,147); and the Netherlands, £4,043 (valves £97).

Dutch Radio and Lamp Exports.

The exports of radio apparatus and accessories from Holland in September are returned at 890 tons of the value of 5,599,000 fl., and at 7,093 tons and 44,923,000 fl. for the nine months ended with September. The latter figures compare with 7,385 tons and 58,924,000 fl. in the corresponding period in 1929. In the case of metal filament lamps the exports in the first nine months are recorded at 38,033,900 lamps of the value of 17,660,000 fl., as against 45,970,200 valued at 21,397,000 fl. in the corresponding period of 1929.

New Italian Companies.

Among the companies recently formed in Italy are the Società Azienda Elettricà di Campoligure, Campoligure, capital 500,000 lire, and La Società Elettricà Frentana, Lanciano, capital, 500,000 lire.

Important Swedish Merger.

It is now officially confirmed that the Allmänna Svenska Elektriska Aktiebolaget (A.S.E.A.) has acquired a majority of shares in the Luth och Rosens Elektriska Aktiebolag. The latter company, however, will continue activity at its own works with a "rational" distribution of orders between the two companies. The A.S.E.A. selling organisation will be enlarged so as to act for both enterprises.—*Reuter's Trade Service* (Stockholm).

British Motors for Detroit.

H.M. Consul at Detroit reports that a local firm is desirous of receiving information and quotations from British manufacturers for equipment, including herring-bone gears and worm speed-reducers, 3-h.p. electric motors, roller chains and sprockets and conveyor chains.

United Kingdom manufacturers of these materials can obtain further particulars upon application to the Department of Overseas Trade, 35, Old Queen Street, S.W.1, quoting reference No. A.X. 10424.

British Trade with Canada.

The Times reports that Mr. H. H. Stevens, the Canadian Minister of Trade and Commerce, speaking at a luncheon last week, said that he and others who came from Canada were asked: "Why does not Canada buy more from the Motherland?" If Canada were on what they might call a free-trade basis—if trade were allowed to flow in its perfectly natural channels—he questioned whether this country would get any trade at all worth speaking of. The trade that Canada now did with the Motherland in the way of imports from Great Britain was largely based on the preference that was given. The thought which he wished to convey to their minds was not the question of preference, but the fact that they would not get any business at all if it were not for the special efforts that had been made to provide the avenue for the business. There was invested in Canada about £500,000,000 of American capital, against about £200,000,000 of British capital. The influence and pressure of that American capital found expression in a startling way. Their American neighbours had established in Canada some 500 branch factories. Canadian workmen and Canadian materials were used—they were very glad that was so—but it meant a concentrated influence of American business men and capital. British branch factories were, he thought, limited to about 70. Was it not sound business for Great Britain to consider the advisability of establishing more branch factories in Canada to take care of the trade which flowed there?

Social Event.

On November 6th, 7th and 8th the Clesco Sports and Social Club (County of London E.S. Co., Ltd., and associated companies) is presenting a second edition of "Electric Tricks" at King George's Hall, Caroline Street, W.C.1. Tickets can be obtained from the hon. secretary, County House, New Broad Street, E.C.2.

Swedish Activity in Austria.

The Allmänna Svenska Elektriska Aktiebolaget has founded an affiliated company at Vienna, the Oesterreichische Elektricitäts-Gesellschaft ASEA, to sell electrical machinery and other products, especially transformers, in Austria, Switzerland, Hungary and Czecho-Slovakia.—*Reuter's Trade Service* (Stockholm).

Book Notices.

"The Glory of Britain," by David Masters. (Pp. 363; 25 illustrations.) London: John Lane, The Bodley Head, Ltd. Price 8s. 6d. net.—Mr. Masters's text is that there is no country like his own (a rather refreshing attitude these days!) and that, so far from being "down and out," Britain will yet show the world what is in her. His book records what Englishmen have contributed to the progress of civilsation in a hundred directions. Due credit is given to the electrical pioneers in a chapter entitled "Electrical Wonders," in which accounts are given of Faraday's work and Swan's invention of the incandescent electric lamp.

"Quantum Chemistry," by Arthur Haas. Pp. ix+75; illustrated. London: Constable & Co., Ltd. Price 6s. net.

"Schlomann-Oldenbourg" Illustrated Technical Dictionaries. Vol. II, Electrical Engineering, covering English, Italian, French, Russian, German, and Spanish. Price £4.

"The Talkies," by John Scotland. Pp. xv+194; illustrated. London: Crosby, Lockwood & Son. Price 7s. 6d. net.

Local Exhibition.

An electrical exhibition was inaugurated at Loughborough on October 20th by Ald. E. Huntsman, president of the British Electrical Development Association, and was continued for a week. One of the chief features of the exhibition was a model house with sitting room, bedroom, bathroom and kitchen electrically equipped. Mr. E. L. Fisher, Loughborough, displayed the latest fittings, and also exhibited a variety of domestic appliances. The Electron Co., Loughborough, showed "Kolster Brandes" radio products and various makes of electric water heaters. At the stand of Messrs. Arthur Marriott, Ltd., an electric washer and ironer were demonstrated and there was an excellent assortment of radiators, fires and sweepers. There were also gramophones with electric pick-ups and wireless sets by well-known makers. Messrs. Gent, Hurlew & Orringe exhibited a range of radiators and gave demonstrations with vacuum cleaners. The stand of the Arora Co. included the company's fires and cookers, while the resources of the Corporation Department were demonstrated by artistic lighting of the front of the hall.

E.D.A. Activities.

The November programme of the British Electrical Development Association includes an interim progress report of the Shop and Display Lighting Campaign. Particulars are also given of the mobile exhibition of electric signs, which has been organised by the Master Sign Makers' Association in conjunction with E.D.A., together with a list of places and dates included in its tour. The remainder of the programme is almost entirely devoted to the Christmas trade, the illustrated advertisements for the national and local Press, the model window display (illustrated in our last issue, p. 687) and the literature for the month, all suggesting electrical gifts for Christmas. A diary of E.D.A. Sales Conferences in the London and Provincial areas is included and the programme concludes with notes by the Director.

The E.D.A. Stand at a Glasgow Exhibition.

The accompanying illustration shows the E.D.A. stand at the Health and Home Exhibition, Kelvin Hall, Glasgow. As this exhibition took place during the period of the Shop and Display Lighting Campaign, opportunity was taken to display a model shop window correctly illuminated, and this aroused considerable interest amongst retail traders. The stand was used as an information bureau for all electrical inquiries.

The North-East Area Committee has arranged a series of lectures to be given in the Lecture Theatre, Tullie House, Carlisle, to teachers of domestic science and others throughout Cumberland. These lectures have been approved by the Directors of Education for Cumberland and Carlisle, and Miss A. M. Penty, Organiser of Domestic Subjects, Cumberland. Some 300 teachers in Cumberland have been circularised and replies already received indicate that a large number intend to be present. A programme of the Sales Conferences for the area is now available.

The Carlisle Circle has arranged an electrical exhibition to be held in the Infantry Drill Hall, Strand Road, Carlisle, from December 6th to 13th inclusive, at which many of the leading manufacturers of electrical domestic appliances will be represented.

The E.D.A.-E.L.M.A. Campaign.

Mr. R. N. Torpy, M.I.E.E., borough electrical engineer of Tunbridge Wells, writes as follows:—"I notice on page 687 in your issue of October 24th that you refer to the E.D.A.-E.L.M.A. Campaign, and the results obtained in Manchester of late shop window lighting through time switches, the percentage being 28.5. I would draw your attention to the fact that in Tunbridge Wells there are 524 shops in all, and of these 175 are fitted with "Venner" time switches for late shop window lighting, a percentage of 33.4 which easily beats the Manchester figure. Besides we have a number of garages on the same scheme which are not included. Through the main thoroughfares the percentage is nearer 75."

Italian Lamp Production.

The production of electric lamps in Italy during May last amounted to 2,283,354, bringing up the total for the first five months of the year to 10,397,296, as compared with 9,404,225 in the corresponding period of 1929.

Austro-French Company.

A company has been formed in Paris (3, Rue Moncey), with a capital of £20,000, and the title La Société pour le Developpement des Forces Motrices en Autriche, to establish hydro-electric plants in Austria.

Bankruptcy Proceedings.

H. F. Spence, 2, Eureka Terrace, Honiton, trading as H. F. Spence & Sons, electrical engineer.—The public examination of this debtor was resumed at the Castle, Exeter, recently. The previous hearing had been adjourned in order that reconciliation accounts might be submitted. That being done, the matter was concluded.

E. Ball, electrical contractor, Old Hall Street, Middleton.—Last day for receiving proofs for dividend, November 5th. Trustee, Mr. J. D. Turner, Byrom Street, Manchester, Official Receiver.

G. F. A. Stone (Stone Manufacturing Co.), electrical accessories manufacturer, 108, Great Saffron Hill, London, E.C.—First and final dividend of 1¼d. in the £, payable any day at Bankruptcy Buildings, Carey Street, W.C.2.

F. W. Wright, electrical engineer, &c., London Road, Tetbury, Gloucester.—Receiving order made October 20th on debtor's own petition. First meeting November 4th at the Official Receiver's Offices, 38, Regent Circus, Swindon. Public examination November 19th, at the County Court Buildings, Clarence Street, Swindon.

A. G. L. Pennock, wireless and electrical dealer, 59, Primrose Hill Street, Coventry.—Receiving order made October 16th on a creditor's petition.—First meeting, October 31st at the Official Receiver's office, 9-11, High Street, Coventry. Public examination, November 10th, at the County Hall, Coventry.

F. H. Graham, electrician, 14, Hilltop Avenue, Harehills, Leeds.—First and final dividend of 1s. 5d. in the £, payable November 6th at the Official Receiver's office, 24, Lower Bond Street, Leeds.

Company Liquidations.

Zone Wireless Co., Ltd.—Liquidator, Mr. G. D. Pepys, Senior Official Receiver, 33, Carey Street, Lincoln's Inn, W.C., released October 15th.

Work Meters, Ltd.—Winding up voluntarily. Liquidator, Mr. W. Thompson, 21, Henry Street, Keighley.

Industrials, Ltd.—A meeting of members will be held at 15-16, Cockspur Street, S.W.1, on November 24th, to receive an account of the winding up of the company by the liquidator, Mr. H. H. Horne.

Electric Sweepers, Ltd.—Meetings of members and creditors will be held at 405, Oxford Street, W.1, on November 28th, to receive an account of the winding up of the company by the liquidator, Mr. J. D. Makgill.

Edson Engineering Co., Ltd.—Meetings of members and creditors will be held at 65, Chancery Lane, W.C.2, on November 25th, to hear an account of the winding up of the company by the liquidator, Mr. E. E. Mills.

Private Arrangements.

E. E. Cross, trading as W. Cross & Son, 183, Green Lane Road, Leicester, electrical and radio engineer.—At a recent meeting of creditors it was stated that a deed of assignment had already been executed. The liabilities under the deed were stated at £815, and in addition there were fully secured creditors for £2,969. The net assets were £468. The business had been in existence continually since 1873, and was taken over by the debtor on the death of his father in 1922. His capital at that date was approximately £725. His last accounts were prepared in January, 1928, and they showed a surplus of assets over liabilities of £1,341. During the last eighteen months, however, the business had declined, and he had also been ill and unable to devote all his attention to it. The retail business had also been affected by the general trade depression. The debtor's wife was a creditor for £200, but that claim was being withdrawn. A resolution was passed confirming the deed of assignment already executed. The following are the principal creditors:—

	£		£
Universal Gramophone and Radio Co., Ltd. ...	42	C. F. Young, Ltd.	20
Walsall Products, Ltd. ...	37	W. Markham	20
General Electric Co., Ltd.	32	W. A. Cross	180
		Rosa E. Cross	200

Meeting of Creditors.

C. A. Middleton, Ltd., 362, City Road, E.C.—A meeting of creditors is called for November 4th at the offices of Messrs. James Todd, Adams and Willcock, 381-399, Salisbury House, Finsbury Circus, E.C.2.

Winding-up Petitions.

Oravox, Ltd.—A petition for the winding up of this company has been presented to the High Court by Mr. F. G. Rust and Mr. F. G. Ratcliffe, 92, Broad Street, Chesham, and will be heard in London on November 3rd.

John King, Ltd.—A petition for the winding up of this company has been presented to the Court of the Chancery of the County Palatine of Lancaster, by Messrs. H. and J. Lonsdale, Ltd., and will be heard by the Vice-Chancellor at the Assize Courts, Strangeways, Manchester, on November 3rd.

Dissolution of Partnership.

Elite Radio Co., wireless engineers, &c., 48 and 72, Pimlico Road, Clitheroe.—Mr. T. Dixon and Mr. H. Jones have dissolved partnership. Mr. Dixon will attend to debts and carry on the business at 16, Castle Gate, Clitheroe.

Deed of Assignment.

J. H. Gath, trading as the Gath Electrical Engineering Co., Halifax.—At a meeting of creditors on October 23rd the deed of assignment executed to Mr. Edgar Sproat, 45 and 47, Commercial Street, Halifax, was confirmed and a committee of inspection was appointed. The following are the members of the committee:—Mr. Douthwaite (L. W. Douthwaite & Co.), Mr. A. Wood (representing the British Thomson Houston Co., Ltd., and other creditors), and Mr. A. Buckley (Wholesale Electro (Halifax), Ltd.). A statement of affairs presented showed liabilities of £831 (£61 preferential) and assets of £260, leaving a deficiency of £571.

Market for Batteries in Brazil.

A confidential report on the market for primary and secondary batteries in Brazil has been prepared by the Department of Overseas Trade from information furnished by H.M. Consular Officers in Brazil, and issued to firms whose names are entered on its Special Register. United Kingdom firms desirous of receiving a copy of this report should communicate with the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1, quoting reference number A.X. 10383.

Legal.

Chagford & Devon Electric Light Co., Ltd.—In the Chancery Division on October 24th Mr. Justice Luxmoore had before him an application in the debenture holders' action of Hamlyn against Chagford & Devon Electric Light Co., Ltd., for an order disposing of the assets of the defendant company. The plaintiff represented the holders of the first mortgage debentures and following judgment in the action the Master in Chancery certified the amount of the assets and sums due to creditors.

Mr. Greenland, for the plaintiff, said the company was incorporated in 1890 with a capital of £20,000 and it issued debentures for a comparatively small sum which were all paid off. In its initial life the company was a well-managed concern, but in 1922 it got into the hands of Colonel Eaton and his associates and immediately the company created an issue of debentures which were to be of an amount not exceeding £8,000. The directors went to all sorts of people and asked them to invest sums of £5, £15, and so on, and they got money anywhere they could, paying no attention whatever to the maximum of £8,000, and from first to last they issued something like £17,000 in debentures. From time to time apparently some of the debenture holders became troublesome and then either this company or some bogus company purported to purchase their debentures for 50 per cent. As the result of that operation, £5,244 of the original debentures were redeemed or sold. The crucial date in the present proceedings was December 15th, 1922, when the maximum of £8,000 was reached. Questions of priority were raised and the Master had to make a certificate the best way he could. The various creditors were divided into classes having regard to their claims. The property of the company was sold for between £4,000 and £5,000. That was more than sufficient to pay the holders of the original debentures up to December, 1922, and leave a small margin after the costs were paid. The original debentures, therefore, would be paid off, and after the payment of costs, the residue of the fund would be apportioned among the debenture holders of the next class according to their principal monies.

Counsel representing all the persons entitled to share in the division assented and his Lordship made an order for the disposal of the fund accordingly.

Trade Announcements.

Messrs. A. J. Coleman & Co., 37-39, The Arcade, Northampton, have appointed Mr. T. Brown-Thomson, formerly of Philips Lamps, Ltd., and Pye Radio, Ltd., as their district representative.

Venreco, Ltd., 55, Neal Street, W.C.2, has become affiliated with Mole-Richardson, Inc., United States. This will enable the company to manufacture kinema studio-lighting equipment from Mole-Richardson designs, and it will also represent the American concern in England and the Continent.

The Alpha Manufacturing & Electrical Co., Ltd., Balham, S.W.12, states that it has received a number of inquiries for "Alpha" electrical appliances of which it is not the maker. The company asks us to state that it has no connection with a Birmingham company understood to be the "Alpha Appliance Co., Ltd."

Messrs. Lewenz & Wilkinson, Ltd., state that they have recently moved into a larger office at 74, Victoria Street, S.W.1. (Telephone numbers: Victoria 1753 and 1754.)

The KERRY ELECTRIC SUPPLY CO., LTD., notifies us that its Dublin address has been changed to Kington Cowper Road, Dublin.

MESSRS. FRANK J. NATHAN & Co., have removed their offices to 57, Mansell Street, E.1. Their warehouse is at 31, West Tenter Street, E.1.

MESSRS. PINCOTT & TARONI, electrical contractors and refrigerating engineers, 1, Liverpool Street, W.C.1, are removing to 152, Norwood Road, S.E.27, and are opening up an electrical and wireless retail business under the name of "Pintar." They ask for catalogues and lists.

The London district office of the "Cosmos" lamp sales department of the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., is now at 75 and 77, Margaret Street, W.1. (Telephone: Museum 3404/5; telegrams: "Metviclamp, Wesdo, London.") The new premises have convenient trade counters and stores and are in an accessible position.

The sales department of the MARCONIPHONE CO., LTD., has been removed to 363, Oxford Street, W.1. (Telephone: Mayfair 1240.) The address of the publicity department is Radio House, Tottenham Court Road, W.1. The orders and credit department and the service department will continue to operate from Dagenham.

Unemployment.

An increase of 12,481 in the number of persons on the registers of employment exchanges of Great Britain was recorded for the week ended October 13th. At that date the total was 2,188,672, as compared with 2,176,191 on October 6th, and 1,215,049 on October 14th, 1929.

New Catalogues and Lists.

SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38-39, Upper Thames Street, London, E.C.4.—An attractive leaflet (No. 439), giving particulars of "Quadray" glass cubes for use either as domestic lighting fittings or for illuminated window displays. Also Catalogue No. 900, giving an illustrated description with technical details of Siemens electricity meters.

JOHN SHAW & SONS (WOLVERHAMPTON), LTD., Wolverhampton.—A folder giving details of "Crescent" electric fires and the "Trojan" vacuum cleaner.

EAGLE ELECTRIC CO., 38, Eccleston Square, S.W.1.—Two leaflets describing the "Eagle Blinker" lamp flasher unit.

The ELECTRICAL ACCESSORIES MANUFACTURING CO., 47, Victoria Street, London, S.W.1.—A calendar blotter with four leaflets attached showing various types of fuse boards and switch fuses.

WOODFYT SALES, LTD., 10a, Newman Street, London, W.1.—A well-produced catalogue containing 48 pages of illustrations and details of "Woodfyt" electric lighting fittings.

SUPFRLAMP, LTD., 92-94, Paul Street, London, E.C.2.—A 56-page illustrated catalogue of radio apparatus and accessories, gramophones, &c.

RINGSDORFF-CARBONS (ENGLAND), LTD., Colindale Avenue, Hendon, London, N.W.9.—A quantity of literature containing descriptions, illustrations and technical details of "Ringsdorff" carbon brushes, brush-holders, contact fingers, flexible connections, &c.

REVO ELECTRIC CO., LTD., Britannia Works, Tividale, Tipton, Staffs.—Folder (No. 164) illustrating new types of "Revo" street-lighting fittings, and an illustrated and priced catalogue (No. H.17) of the company's latest electric fires and domestic appliances.

HUGH J. SCOTT & Co. (BELFAST), LTD., Volt Works, Ravenhill Avenue, Belfast.—A cardboard folder showing quickly and easily the types and prices of electric motors most generally in demand for industrial purposes.

L. G. HAWKINS & Co., LTD., 30/35, Drury Lane, Kingsway, London, W.C.2.—Leaflet No. 113, giving full details of "Peter-the-Heater," a combined motor-car heater and inspection lamp.

POWER CONTRACTS (BATWIN), LTD., 138, Southwark Street, London, S.E.1.—A catalogue, illustrated and priced, of the new Batwin "M" type electric motors.

OSLER & FARADAY, LTD., 89-91, Newman Street, London, W.1.—A well-produced catalogue illustrating, partly in colour, the new "Pastelite" lighting fittings.

ELECTRO-GAS DEVELOPMENT CO., LTD., 3, Arundel Street, London, W.C.2.—A brochure containing particulars, illustrations and prices of the "Electrorad" system of low-temperature radiant heating.

FALK, STADELMANN & Co., LTD., 83-93, Farringdon Road, London, E.C.1.—Catalogue No. 634, comprising 196 pages of illustrations and details of electric lighting accessories, cables, conduits, motors, bells, telephones, &c.

The SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, London, W.C.2.—A most comprehensive catalogue, excellently illustrated, of the new season's radio receivers, loud-speakers and components.

IGRANIC ELECTRIC CO., LTD., 149, Queen Victoria Street, London, E.C.4.—Leaflet No. 125 and print No. 1,080, illustrating multiple-clapper self-acting starters and master switches.

The MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, London, W.1.—A folder and circular letter announcing the release of two new loud-speakers—models 62 and 63.

KORTING & MATHIESEN, LTD., 711 and 715, Fulham Road, London, S.W.6.—The "Kandem Quarterly Review" containing interesting articles on floodlighting, film and photographic lighting, and lighting in horticulture. Also two folders (Nos. 1,228b and F.1928a) dealing respectively with "Kandem" floodlight projectors and one-piece reflectors for industrial lighting.

S. G. BROWN, LTD., North Acton, London, W.3.—The October issue of the "Brown Budget," a special number dealing with Brown radio receivers.

CROMPTON PARKINSON, LTD., Guiseley, Leeds.—Catalogue No. A.503 describing and illustrating steel-clad cubicle switchgear.

DAVID BROWN & SONS (HUDDERSFIELD), LTD., Park Works, Lockwood, Huddersfield.—Technical data sheets Nos. 1,301 and 1,302, giving particulars of the standard helical single increasing or single reducing gears.

Electrical Contractors' Supplies for China.

A confidential report on the market for electrical contractors' supplies in China has been prepared by the Department of Overseas Trade from information furnished by the Acting Commercial Counsellor, Shanghai, and issued to firms whose names are entered on its Special Register. United Kingdom firms desirous of receiving a copy of this report should communicate with the Department, 35, Old Queen Street, S.W.1. Reference number A.X. 10385 should be quoted.

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Oct. 28th	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	...
a	Ammoniac, Sal ... ... per ton	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£17	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... . per lb.	3d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3¾d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton.	£85 to £90	£10 dec.
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metals—		
	Grade I ... ... per ton net.	£115	£5 inc.
	Grade II ... ... ,, ,,	£84	£3 inc.
	Grade III ... ... ,, ,,	£52	£2 inc.
c	Brass (rolled metal 2" to 12" basis) per lb.	7¾d.	¼d. dec.
c	,, Tubes (solid drawn) ... ,,	9¼d. to 10d.	¼d. dec.
c	,, Wire, basis ... ... ,,	8d.	¼d. dec.
c	Copper Tubes (solid drawn) ... ,,	11d.	¼d. dec.
g	,, Bars (best selected) ... per ton	£73	£2 dec.
g	,, Sheet ... ... ,,	£73	£2 dec.
g	,, Rod ... ... ,,	£73	£2 dec.
d	,, (Electrolytic) Bars ... ,,	£49	...
d	,, ,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ... ,,	£59	...
d	,, ,, H.C. Wire per lb.	7¾d.	...
f	Ebonite Rod ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/1	...
h	Gutta-percha, fine ... ... ,,	nom.	...
h	India-rubber, Para fine ... ... ,,	5¾d.	¼d. inc.
i	Iron, Pig (Cleveland No. 3.) ... per ton.	63/6	...
	,, Wire, galv. No. 8. P.O. qual. ,,	£20	...
g	Lead, English pig ... ... ,,	£16 15s.	...
g	Mercury ... ... per bot.	£22 12s. 6d. to £22 15s.	...
e	Mica (in original cases) small ... per lb.	6d. to 3/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plain castings ,,	1/1½d.	...
p	,, ,, drawn bars & rods ,,	1/0½d.	¼d. dec.
p	,, ,, rolled strip & sheet ,,	1/0½d.	...
p	,, ,, wire ... ... ,,	1/0¾d.	...
o	Platinum ... ... per oz.	£7	...
d	Silicium Bronze Wire ... ... per lb.	9¾d.	...
r	Steel, Magnet, in bars ... ... ,,	7¾d.	...
g	Tin, Block (English) ... ... per ton	£120 5s. to £121 5s.	£2 5s. inc.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	2/11	2d. dec.

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a	G. Boor & Co.	g	James & Shakespeare.
b	The British Aluminium Co., Ltd.	h	Edward Till & Co.
c	Thos. Bolton & Sons, Ltd.	i	Bolling & Lowe.
d	Frederick Smith & Co.	l	Richard Johnson & Nephew, Ltd.
e	F. Wiggins & Sons.	n	P. Ormiston & Sons.
f	India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	o	Johnson, Matthey & Co., Ltd.
		p	C. Clifford & Son, Ltd.
		r	W. F. Dennis & Co.

In their letter dated October 25th, Messrs. James Forster and Co. state that the lead market kept steady at the beginning of last week, but later, on moderate offerings, prices declined, the market closing with a weak tone. Demand from home consumers has again subsided while the Continent is doing practically nothing, so that with no support whatever from producing interests and ample supplies arriving it was not surprising to see the price decline again.

For Sale.

Tenders are invited by the Southend-on-Sea Electricity Department for the purchase of miscellaneous power station plant.

The London County Council invites tenders for the purchase and removal of tramway sub-station plant.

Various trade stocks of wireless and electrical goods, machinery, tools, &c., will be sold by auction on November 5th, 6th, 11th, 12th and 13th by Mr. Henry J. Shaw.

Messrs. Wheatley Kirk, Price & Co. will sell by auction on November 18th and following days the freehold engineering works of Messrs. Kerr, Stuart & Co., Ltd., in Wheildon Road, Stoke-on-Trent, with plant, machinery, stores, Diesel locomotives and lorries, furniture, &c.

(See our advertisement pages to-day.)

Electric Conduit for Canada.

The Department of Overseas Trade has received an inquiry from a firm in Vancouver desirous of receiving quotations for electric wiring conduits. United Kingdom manufacturers can obtain further particulars on application to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. Reference A.X. 10430 should be quoted.

A Travelling Showroom.

The County of London Electric Supply Co., Ltd., has just placed upon the road a large completely-fitted travelling showroom for the exhibition and demonstration of domestic electrical appliances. It is to stay a fortnight in each district in which the company and its associates supply electricity, mainly in the smaller towns and villages of Essex.

Lighting and Power Notes.

Accrington.—Year's Working.—We have received from Mr. A. W. Clegg, engineer and manager of the Corporation Electricity Department, a copy of the accounts of the undertaking for the year ended March 31st last. The total revenue amounted to £82,419, as compared with £82,842 in the preceding year, and the working expenses were £42,236, as against £41,034. The gross profit fell from £41,808 to £40,183 and after making provision for interest on loans, sinking fund, &c., there was a net surplus of £6,886, as compared with £9,683 in 1928-29. The net capital expenditure during the year amounted to £34,314, bringing the total now spent on the undertaking to £573,756. The total sales of electricity increased from 17,687,398 to 17,907,615 kWh, although there was a drop of over 400,000 kWh in the energy consumed for power and heating purposes; the maximum demand recorded was 9,200 kW, as against 9,000 kW. The average price obtained per kWh rose from 1.119d. to 1.132d.

Australia.—Additional Plant for Perth Power Station.—A few months ago tenders were received and recommendations made for additional generating plant for the Government power house at Perth, West Australia. Owing to the financial position, however, the actual placing of the orders was delayed, but the Minister of Railways now hopes to settle these contracts shortly. It is regarded as very urgent that the plant should be installed soon, as it will take two years after the acceptance of the tenders to get the new plant into operation, and the continually growing demand on the existing plant is so heavy that there is no reserve in case of emergency. The total cost of the addition is estimated at £300,000.

Bakewell.—Lighting Installation Scheme Rejected.—The Ministry of Health has refused to sanction the installation of electric lighting in the Bakewell Rural District Council's houses at Beeley, Tideswell and Youlgreave unless the rents are increased by 3d. a week.

Bedford.—Loans Sanctioned.—The Corporation Electricity Committee has received sanction to loans of £2,000 for the electricity undertaking, £975 for mains and services, £3,122 for the provision of railway sidings, £2,678 for plant and £4,880 for transformers.

Bexhill-on-Sea.—Year's Working.—We have received from Mr. C. A. Frost, borough electrical engineer, a copy of his report, together with a statement of accounts of the Electricity Department for the year ended March 31st last. The total revenue amounted to £38,680, as compared with £39,476 in the preceding year, while the working expenditure showed an increase from £27,149 to £28,830. The gross profit declined from £12,327 to £9,849, and after deducting capital and other charges there was a net deficiency of £389, which compares with a net surplus of £3,028 in 1928-29. During the year £10,901 was spent on capital account, bringing the total expenditure on the undertaking to £187,581. Electricity sold for all purposes increased from 3,716,045 to 4,236,937 kWh, but the maximum load dropped from 2,652 to 2,581 kW. The average price obtained per kWh fell from 2.57d. to 2.18d.

Bury St. Edmunds.—Assisted Wiring Scheme.—The Town Council has applied for sanction to a loan of £5,000 in connection with the assisted wiring scheme.

Canada.—The Toronto Hydro-Electric System.—The nineteenth annual report of the Toronto Electricity Commissioners covering the year ended December 31st last has recently come to hand. Including appliance sales the total revenue from the hydro-electric system amounted to $12,211,222, which compares with $11,083,883 in the preceding year. Working expenses, including the purchase of electrical energy from the Hydro-Electric Power Commission of Ontario and Appliance Department costs, were $8,518,711, as compared with $7,809,639, leaving a gross profit of $3,692,511 ($3,274,244). From this the following charges had to be met: Interest on loans, $1,314,870; depreciation, $659,669; taxes, $28,568; fixed charges *re* York township, $78,000; sinking funds, $329,862; and redemption funds, $619,252. There was thus a net surplus of $662,290, as compared with $311,688 in 1928. The sales of electrical energy increased from 675,026,262 to 775,401,353 kWh, and the maximum supply demanded from 259,579 to 290,324 h.p.

Cheltenham.—Year's Working.—The accounts of the Corporation Electricity Department (engineer: Mr. W. J. Bache) for the twelve months ended March 31st last show a total revenue of £70,207, a working expenditure of £51,660 and a gross profit of £18,547. From the gross profit had to be paid loan interest (£6,624), sinking fund contributions (£8,420) and sundry smaller items, leaving a net surplus of £2,640. On capital account £25,346 was spent during the year which makes the total now spent on the undertaking £388,680. The electricity sold for all purposes increased from 6,882,777 to 7,296,471 kWh; only 489,857 kWh, as compared with 603,874 kWh in the preceding year, was, however, used for traction purposes.

Continental.—Germany.—The output of the 122 principal electric power stations in Germany during the seven months ended July last amounted to 9,387,800,000 kWh, as compared with 9,302,100,000 kWh in the corresponding period a year ago. It is noteworthy, however, that the increase occurred during the first three months of the year, the output during each of the succeeding months showing a decline.

Russia.—According to the organ of the Supreme Council of National Economy, the establishment of electricity supply works is not proceeding as rapidly as was contemplated. During the first ten months of the fiscal year ended September, 1930, the proposed works of construction were only carried out to the extent of 51 per cent. The delay is ascribed chiefly to the shortage of labour.

Rumania.—The Gura-Ocuitei power station of the Hydrofina Co., which supplies electricity for the oil works of the Concordia Co., is about to be extended by the addition of two sets of 7,600-h.p. steam turbo-generators. A feature of the plant is that the boilers are fired by waste oil from the oil wells.

Czecho-Slovakia.—Figures published recently indicate steady progress in the production of electrical energy in Czecho-Slovakia. Since the establishment of the country's independence in 1918, the number of generating stations has been almost doubled, increasing from 4,162 in 1918 to 7,940 in 1928. The electrical energy produced in 1928 amounted to 2,748,537,000 kWh, as compared with 2,381,264,000 kWh in the preceding year, and only 963,671,000 kWh in 1918. A commencement is shortly to be made with the construction in Moravia of a new generating station which, when completed, will be one of the largest in the country.

Belgium.—The *Financial Times* states that as a means of bringing about a concentration of Belgian electricity interests, discussions have commenced between the Sofina and Empain groups with the aim of achieving technical collaboration between power centres and stations in Belgium. The outcome will probably be the erection of power stations; in which case it is likely that a new company will be formed to operate them

Croydon.—Loan Sanctioned.—The Corporation Electricity Committee has obtained sanction to a loan of £3,465 for sub-station buildings, mains and plant.

Mains Extensions.—Mains extensions are to be carried out at a cost of £3,726.

Dodworth.—Street Lighting.—The Urban District Council is negotiating with the Yorkshire Electric Power Co., with the object of having the streets of the town lighted by electricity.

Dutch East Indies.—Electrical Development.—During the past financial year the Algemeene Nederlandsch-Indische Electriciteit Maatschappij secured concessions for the supply of electrical energy to seventeen additional small towns in Java and Borneo.

Ealing.—Change-over Scheme.—Sanction has been received by the Town Council to the borrowing of £80,000, being part of the cost of carrying out the first stage of the scheme to change over the system of supply from single- to three-phase.

Enlargement of Sub-station.—The Electricity Supply Committee reports that it is necessary, in order to deal with the new supply from the 33,000-V main, that the Kingsbridge Avenue sub-station should be enlarged.

Gatehouse (Galloway).—Electricity Scheme.—Representatives of Dalbeattie Electric Light and Power Co., Ltd., met the Town Council on October 21st; they are to submit a scheme for electric lighting of the town.

Halifax.—YEAR'S WORKING.—We have received from Mr. F. N. Rendell-Baker, borough electrical engineer, a copy of the accounts of the Electricity Department for the year ended March 31st last. The total revenue amounted to £199,764, as compared with £194,766 in the preceding year, while the working expenditure showed a decrease from £92,302 to £89,494. There was a gross profit of £110,271, as compared with £102,464, and to it was added income from other sources making a total of £116,034 available for distribution. Interest on loans absorbed £34,492, sinking fund contributions £35,604, income tax £5,650, and bank interest £1,419. There remained a net surplus of £38,869, which compares with £32,584 in 1928-29. During the year the expenditure on capital account amounted to £64,882 and included £24,249 for machinery and £31,738 for mains and services; the total now spent on the undertaking is £1,035,881. Sales of electricity increased from 31,081,590 to 32,290,771 kWh, and the maximum supply demanded from 17,100 to 17,500 kW. The average price obtained per kWh declined from 1.504d. to 1.485d. A new agreement with the Hebden Bridge Urban District Council for bulk supply was made during the year. This agreement is for a period of 21 years, and whereas formerly Hebden Bridge took only a partial supply from Halifax, provision is made under the new agreement for the whole of its supply. A hire-purchase wiring scheme was introduced, and although this scheme was only in operation for the last three months of the year, approximately 160 consumers took advantage of the facilities offered. Good progress was made with the work of changing over from d.c. to a.c.

Irish Free State.—LIMERICK.—The Electricity Supply Board has granted a concession to Limerick consumers in response to a resolution on the subject passed recently by the Limerick Chamber of Commerce. An option is now given to Limerick consumers of paying for electricity either on a flat rate, or on a valuation basis, as is the case in Dublin and Cork.

CORK.—The Committee of Management of the Cork Mental Hospital is negotiating for the installation of electric lighting at the institution.

Kenya.—POWER DEVELOPMENT APPLICATION REFUSED.—After four years' negotiation the Kenya Government and the Colonial Office have refused the application of the East African Power and Lighting Company to develop new power on the reaches of the Tana river at a cost of £250,000. *The Times* states, however, that commercial circles in the Colony are approaching the Joint East African Board, the London Chamber, and other East African quarters in London to secure a reopening of the subject.

Korea.—HYDRO-ELECTRIC DEVELOPMENT.—The development of about 10,000 kW of hydro-electric power is contemplated by the North Korea Power Co., Ltd.

London.—HAMMERSMITH.—In connection with the bulk supply of electricity by the London and Home Counties Joint Electricity Authority, it is proposed that the Joint Authority or the Central Electricity Board should, in carrying out the works necessary to enable the supply to be given to the Council, at the same time provide on behalf of the Council the requisite plant and switchgear. It is recommended that application be made for sanction to a loan of £3,500, the estimated cost of the works referred to.

BATTERSEA.—The Borough Council Highways Committee recommends the conversion of 48 gas lamps on Clapham and Wandsworth Commons to electricity at a cost of £1,956. These are the only lamps in the borough which the Council has not yet decided to convert to electricity. The Electricity Committee is to provide electricity services at 110 premises, at a cost of £1,094; extend mains for private services, at a cost of £242; and replace with armoured cable old vulcanised bitumen distributors, at a cost of £612.

STOKE NEWINGTON.—Sanction has been received to loans of £3,800 for mains and £1,200 for sub-station equipment.

The Borough Council Electricity Committee has approved the plans of the Northern Sub-station and has decided to obtain tenders for the erection of the building and for the provision of the necessary plant and switchgear.

Morecambe.—STREET LIGHTING.—The Corporation has approved the expenditure of not more than £1,000 for the laying of cable and the provision of standards and lanterns along the portion of the Coastal Road which lies within the borough.

New Zealand.—HYDRO-ELECTRIC DEVELOPMENT.—The Finance Bill which was introduced into the House of Representatives last week empowers the Government to borrow £5,000,000 for public works. Of this £2,000,000 is to be spent on hydro-electric works.—*Reuter* (Wellington).

WELLINGTON.—An increase in the total revenue from £325,823 to £358,887 is recorded in the accounts of the city electricity undertaking (general manager: Mr. M. Cable) for the year ended March 31st last. The working expenditure amounted to £162,706, as compared with £137,463 in 1928-29, and there was a gross profit of £196,181 (£188,360). After providing for interest on loans (£29,832), sinking fund (£7,300), renewals (£19,565) and reserve fund (£19,565), there was a net surplus of £119 957, as against £114,810 in the preceding year. During the year £45,845 was spent on capital account, bringing the total now spent on the undertaking to £1,086,297. Electrical energy sold increased from 33,143,536 to 41,329,434 kWh, and the maximum load from 13,682 to 15,424 kW.; there was an increase of 1,700 in the number of consumers, making a total of 26,700. The average revenue obtained per kWh fell from 2.33d. to 2.06d.

Northern Ireland.—LURGAN.—The Northern Ireland Ministry of Commerce has written to the Lurgan Urban District Council in regard to the Council's application for a loan of £9,000 for its electricity scheme, stating that the Ministry would provisionally sanction a sum of £6,900 for the purpose of providing transformers and other transmission plant.

Northfleet.—PROPOSED ACQUISITION OF UNDERTAKING.—At a meeting of the Urban District Council, the clerk submitted particulars of the terms upon which the Council could acquire the rights to supply electricity in the district. It was decided that further information should be obtained as to the cost of obtaining and distributing a supply.

Preston.—CHANGE-OVER SCHEME.—The Town Council has received sanction to the borrowing of £120,000 for mains, plant, meters, and works, in connection with the change of system of supply from d.c. to a.c.

Special Orders.—Application is being made by the South Wales Electrical Power Distribution Co. for a Special Order authorising it to supply electricity in certain parishes in the rural districts of Abergavenny, Pontypool and Magor.

The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Urban Electric Supply Co., Ltd., to supply electricity in the borough of Stamford and in parts of Kesteven in the county of Lincoln.

Stoke-on-Trent.—EXTENSIONS.—The Corporation Electricity Committee is to extend mains to supply 78 houses proposed to be erected on the Etruria Vale and Meir housing estates. An additional three-phase l.p. main costing £650 is also to be laid to the Dalehall Pottery.

Tynemouth.—CHANGE-OVER SCHEME.—The Corporation Electricity Committee has further considered the question of the change-over in periodicity from forty to fifty cycles. The electrical engineer again recommended that the Newcastle-upon-Tyne Electric Supply Co. should carry out the work for the Corporation, and said that the Electricity Commissioners were in favour of this course. The recommendation was adopted.

Uttoxeter.—INAUGURATION OF SUPPLY.—Uttoxeter's electricity scheme, which has been carried out at a cost of £22,349, was inaugurated on October 18th when the managing engineer of the Power Lines Construction Co., Ltd., switched on the supply at the transformer station. Electricity is obtained by overhead wires from the Marchington sub-station, where the Burton-on-Trent lines are linked with those of the Urban District Council. The main expenditure has been on mains and services, which have cost £18,359.

Weymouth and Melcombe Regis.—YEAR'S WORKING.—We have received from Mr. G. Nicolson, borough electrical engineer, a copy of the accounts of the Electricity Department together with an extract from the report of the Electricity Committee for the year ended March 31st last. The total revenue amounted to £35,540 and there was a working expenditure of £20,266, leaving a gross profit of £15,274. The previous year's figures were: Income, £33,057; working expenses, £16,719; gross profit, £16,337. After deducting capital and other charges, there was a net surplus of £1,053, as compared with £6,024 in the preceding year. During the year the capital expenditure amounted to £31,169, bringing the total now spent on the undertaking to £249,779. Electrical energy sold increased from 2,588,898 to 3,032,517 kWh and the maximum load from 1,492 to 1,754 kW. Since July, 1929, supplies of electrical energy have been available in Wyke Regis, Broadwey, Upwey, Overcombe and part of Preston. At the present time the supply is being extended to Sutton Poyntz and then to Osmington. Arrangements were also made for the Portland Urban District Council to take a bulk supply, as from July 1st, 1930.

Willington.—SUPPLY TO HOUSING ESTATE.—The Urban District Council has applied to the Minister of Health for consent to install electricity in the houses on the Rosedale estate.

Wimbledon. — YEAR'S WORKING. — The revenue of the Borough Council Electricity Department (engineer and manager: Mr. A. E. McKenzie) showed an increase from £171,060 to £187,555 for the year ended March 31st last. Working expenses amounted to £97,487, as compared with £82,350 in the preceding year, and there was a gross profit of £90,067 (£88,710). After providing for loan interest and redemption, there was a net surplus of £20,310, which compares with £27,063 in 1928-29. The capital expenditure during the year amounted to £102,371 and included £52,770 for mains and services. Sales of electricity increased from 22,467,621 to 25,388,075 kWh, but the maximum supply demanded fell from 13,050 to 12,600 kW. The average price obtained per kWh declined from 1.660d. to 1.626d. During the year under review the charge for street lighting was reduced from 2d. to 1½d. per kWh. This reduction, together with substantial reductions in the power, heating, and cooking tariffs, has resulted in concessions to consumers amounting to £5,620.

Tramway and Railway Notes.

Australia.—Proposed Electric Railway.—According to *Tenders*, a proposal to construct an electric railway by way of a tunnel under the Yarra river connecting Williamstown with Port Melbourne, Vic., has been submitted to the Williamstown Council by Mr. E. W. C. Kearney.

Railless Cars.—The N.S.W. Metropolitan Transport Trust is considering the establishment of a railless-car system between Manly and Spit Junction.

Blackburn.—Railless Cars.—The Corporation is to apply for powers to operate railless-car services.

Continental.—Austria.—It is reported from Vienna that the new Federal Railway Administration has decided in principle to resume the work of electrification as the results hitherto obtained have proved to be wholly satisfactory. The expenditure on the Salzburg-Vienna section is estimated at 175 million schillings and on the Vienna-Graz section at 125 million schillings.

Sweden.—It is stated that 96 electric locomotives will be required for the electrification of the Swedish Southern Railway and the Nassjo-Falkoping line, the conversion of which was recently approved in principle by the Riksdag. In connection with this matter the State railway administration has entered into preliminary contracts with three firms for the construction of these locomotives and with the Allmänna Svenska Elektriska Aktiebolaget for the electrical equipment of them. The firm of Nydqvist and Holm, of Tröllhattan, is to build 37 of the engines.

Darlington.—Railless-car Extensions.—The Corporation has applied to the Minister of Transport for a Provisional Order authorising it to run railless-car services on five new routes.

London.—Tube Stations to be Connected.—A scheme costing approximately £170,000 for the linking up of the British Museum station on the Central London Railway and the Holborn station on the Piccadilly line, is to be carried out very shortly. It is planned to construct a tunnel 170 yards in length to connect the two stations, with an elaborate system of escalators; at present passengers wishing to change from one line to the other have to come up to the street level and walk across High Holborn. On the completion of the scheme, which will take over two years, the British Museum station will be closed and Holborn will deal with passengers on both lines.

New Zealand.—Wellington.—The annual report on the working of the city tramway undertaking (general manager: Mr. M. Cable) for the year ended March 31st last records a total revenue of £458,397, as compared with £451,181 in the previous year. Working expenses amounted to £342,571, as against £336,448, the gross profit declining from £114,733 to £115,826. After providing for interest on loans (£41,598), sinking-fund (£9,412), renewals (£22,379), reserve fund (£22,379), and a debit balance of £14,627 from the motor-omnibus account, there was a net profit of £5,431, as compared with £9,708 in the previous year. Capital expenditure during the year amounted to £55,964 and included £33,489 for tramcars; the total now spent on the undertaking is £1,368,611. The number of passengers carried by the trams and railless cars increased from 45,745,050 to 46,581,456, and the care mileage from 4,159,125 to 4,308,624. The average receipts per car mile fell from 26.03d. to 25.53d.

Nottingham.—Railless Cars.—The Corporation proposes to run railless cars, from the western portion of the city to Trent Bridge, and to open up several important new routes in suburban areas.

Telegraph and Telephone Notes.

Belgium.—New Cable.—A cable giving direct communication between La Panne, on the Belgian coast, South America, and the States of the Latin Union, was inaugurated on October 22nd, says *The Times*. The cable was constructed by an Italian company. Telegrams were exchanged between the King of the Belgians and the King of Italy and the heads of States interested.

Denmark.—Telephony.—The total receipts of the private telephone companies during 1929 aggregated about 45,300,000 Danish crowns (one crown equals about $0.268), as compared with 44,100,000 crowns in 1928, according to the yearly report of the State Board of Control, says *Commerce Reports*, and 13,600,000 crowns was expended on new equipment. The book value of the equipment is placed at 158,250,000 crowns, and the property is valued at 13,400,000 crowns. The private telephone system now comprises 1,723 central exchanges, as against 1,738 last year. The number of city exchanges remains the same, however, at 107. The line length, including aerial lines and cables for both subscribers and central exchanges, slightly exceeds 1,400,000 km. (869,918 miles) of wire; of this total, 1,200,000 km. (748,644 miles) are subscribers' lines. Comparative figures for the previous year were 1,300,000 km. (807,781 miles) and 1,100,000 km. (683,507 miles), respectively. The total line length of the State telephone system is about 84,000 km. (52,195 miles). The number of telephone poles in use is about 800,000. On December 31st, 1929, the total number of telephones per 1,000 inhabitants was 94, or, roughly, one telephone for every 11 persons.

Persia.—Wireless Communication.—The Minister of Posts and Telegraphs officially inaugurated on October 26th on behalf of the Shah direct short-wave radio-telegraph communication between Persia and Europe and Persia and Iraq, in addition to the already existing long-wave installation communicating with Russia, Turkey, and Syria. As the result of notice given to the Postmasters-General of Great Britain, France, and Germany, the last tests were satisfactorily carried out and communication was established with wireless stations in those countries. Complimentary telegrams were exchanged and the Persian Minister of Posts alluded to the fact that under the Shah's auspices Persia now owned an installation which conformed to the latest technical progress.—*Reuter* (Teheran).

Scotland.—Islands Communication.—A strong appeal is being made to the Postmaster-General on behalf of the inhabitants of Barra, Lewis, and other Hebridean islands, for the installation of telephones in every village and district. Although the small communities of crofters are not able to afford the guarantee of £8 which is necessary before a public telephone can be installed, it is urged that there must be a complete system of telephone communication if the medical services which have been organised by the Scottish Board of Health are to be effective.

Wireless emergency plant has been erected at the Lerwick Post Office and experiments in the reception and transmission of messages are being carried out with the object of establishing communication with the Wick station for use whenever the islands are isolated owing to broken cables. It is understood that the intention of the Post Office is to provide small wireless sets for a number of the islands, which at present have no means of communication with the mainland.

United States.—Telephony.—Telephones are now being installed in Europe faster than in the United States. According to the U.S. Department of Commerce installations in Europe are increasing by 8 per cent. per annum, as compared with 4½ per cent. in America. Although there are still less than half as many telephones in Europe as there are in North America, the number in Europe has doubled in the past ten years. There are at present twenty million telephones in the United States.—*Reuter* (New York).

Radio Notes.

Australia.—Licences.—The total number of receiving licences in use in the Commonwealth on August 31st was 335,037, the increase of 16,616 for the month being a record. In Victoria 147,180 licences were in use and 120,673 in New South Wales.

Canada. — Licences. — According to the radio-telegraph branch of the Department of Marine, licensed listeners number 500,000, which figure represents 80 per cent. of the sets actually in use.

France.—Power Increase.—The Radio Agen station, which was destroyed by floods last March, is to be reconstructed, 300,000 fr. having been voted by the Council of the Department of Lot-et-Garonne with this object. *World-Radio* understands that the station at Beziers will be increasing its power from 0.6 kW to 10 kW (aerial) at an early date, and that Radio-Vitus which is to be removed to the Paris suburb of Romainville, will increase its power to 2 kW this month, and to 20 kW during the coming spring. It is intended to use the latter transmitter exclusively for experimental television transmissions. The ordinary transmissions of this station have already ceased, with the exception of those on Sunday morning.

Germany.—Licences.—The number of licences on October 1st was 3,241,725. Compared with July 1st last (3,224,944), says *World-Radio*, it represents an increase of 16,781, or about 0.5 per cent., and compared with the figures on October 1st of last year (2,843,569), an increase of 398,156, or 14 per cent. Taking the total population at the end of 1929 (64,104,000) as a basis, there are 50.6 owners of receiving sets for every 1,000 inhabitants.

International Relay.—London Ceremony.—The B.B.C. arranged an international broadcast in connection with the deposit of the ratifications of the London naval treaty on October 27th. Consecutive speeches by the Japanese Prime Minister in Tokyo, the President of the United States of America in Washington, and the British Prime Minister and the Japanese Ambassador, both in London, were relayed by broadcasting stations in Japan, the U.S.A., and Great Britain. It was the first attempt to relay in this country a speech originating in Japan. The transatlantic telephone service was used for linking Washington to London and the extension from Washington

to Japan was made by means of experimental short-wave link across the Pacific Ocean.

New Zealand.—LICENCES.—Besides the R.B.C.'s four YA stations, 19 smaller B-class stations are in regular operation, some nightly and some once weekly only. Listeners' licences number 50,000, but recently within a period of six weeks nearly 100 pirates were convicted in Auckland alone, says *World-Radio*. This year's revenue is estimated at £70,000. The Government is to assume control of the technical side of the service in 1932.

Sweden.—LICENCES.—Receiving licences number 466,750, an increase of 5,134 during the quarter ended September 30th, 1930, corresponding to 76.8 listeners per 1,000 inhabitants.

United States.—NEW VALVE.—The new transmitting station (KDKA) being built near Saxonburg, Pa., will incorporate innovations developed by the Westinghouse Electric and Manufacting Company. The most important is a new 200-kW valve, which is not merely an enlarged edition, for the quality of output and life of such a valve would not be up to the desired standard. The new AW-220 valve is 72 in. in height, has a diameter of 8 in., and weighs 60 lb. One of the greatest problems was the cooling of the grid, which difficulty has been overcome by a double-end construction. Approximately five tons of cooling water must be passed through the water jacket of the valve each hour it is in operation. The water cools the valve in the same manner as water in an automobile cools the engine.

RECEIVER SET STATISTICS.—There were 13,478,600 wireless sets in use in the United States on July 1st, 1930, or one set to about every ten persons. New York, with 1,752,000, had the largest number and California was second with 1,470,000 sets.—*Reuter* (Washington).

Wireless for the Blind.—FUND APPEAL.—The B.B.C. announces that the appeal recently broadcast in aid of the Wireless for the Blind Fund has resulted in individual contributions towards the cost of supplying blind persons with wireless sets ranging from sixpence to £25. Some 15,000 blind persons are still in need of sets. Free sets have been distributed to 6,500 persons since the fund was opened last Christmas night, and it is hoped that the number will be increased to 9,000 by the end of December next. More than 10,000 sets will thereafter be needed if the ambition to supply every blind person in the country with a wireless set is to be realised.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—Posts and Telegraphs Department. November 18th. V.i.r. lead and antimony covered cable. (A.X. 10400.)*
December 2nd. Cord tags. (A.X. 10332.)*
January 6th. Indicators. (A.X. 10403.)* Submarine cable. (A.X. 10309.)*
BRISBANE.—November 24th. City Electric Light Co., Ltd. 45,000-V and 11,000-V switchgear. (A.X. 10399.)*
December 8th. Four 5,000-kVA single-phase transformers (A.X. 10393.)*
SYDNEY (N.S.W.).—November 5th. Government Railways. Three 333-kVA single-phase transformers. (A.X. 10394.)*

Belgium.—SAINT-GILLES, BRUSSELS.—November 1st. Municipal Council. 1,000 3-amp., 222-V amp.-hour electricity meters, 1,400 5-amp. ditto, and 100 10-amp. ditto. Particulars (Cahier des Charges) for 5 francs from Service de l'Electricité, 40, Rue de Bethléem, Saint Gilles. Tenders to Hotel Communal.

Bradford.—November 8th. Tramways Committee. Twelve months' supply of stores, including electrical fittings for tramcars (Sch. No. 3), insulating material and delivery hose (No. 4), insulated bolts, strains and copper controller contacts (No. 7). Schedules numbered as above from tramway general manager, 11, Forster Square.

Canada.—TORONTO.—November 5th. Chats Falls Executive Board. 13.2-kV metal-clad switchgear. (A.X. 10415.)*

Farnworth.—November 4th. Electricity Department. L.p. cables. (October 24th.)

Glasgow.—November 5th. Corporation Public Assistance Department. Stores, including electrical fittings, for various institutions for twelve months. Specifications and forms from Contracts Department, 266, George Street; offers to town clerk.

India.—NEW DELHI.—November 12th. India Store Department. Cables, junction boxes, and switchgear. (A.X. 10377.)*

London.—CENTRAL ELECTRICITY BOARD.—November 3rd. 132,000-V overhead transmission lines for the South-West England and South Wales Electricity Scheme. (September 26th.)
November 3rd. 132-V overhead transmission lines for the North-East England Electricity Scheme. (September 26th.)
November 3rd. Construction of site works, foundation works and buildings in the area of the Central England Electricity Scheme. (September 26th.)
November 10th. 66,000-V transformers. (October 10th.)
November 24th. 66,000-V and lower voltage transformers. (October 17th.)
COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD.—November 11th. Circulating water pumps and pump house equipment, in connection with the Barking extensions. (October 10th.)
LONDON COUNTY COUNCIL.—November 3rd. Two 20,000-kW turbo-alternators, condensing plant, &c. (September 26th.)

SOUTHWARK.—November 7th. Borough Council. Twelve months' supply of electric cables. (October 17th.)

H.M. OFFICE OF WORKS.—November 13th. Supply and laying of cables at the National Physical Laboratory. (October 24th.)

STOKE NEWINGTON.—November 4th. Electricity Department. L.p. cables and d.c. house service prepayment meters. (October 24th.)

Lourenco Marques. — QUELIMANE. — Municipal Council. Diesel engines and dynamos. (A.X. 10439.)*

Manchester.—November 19th. Electricity Department. Fire extinguishing equipment for transformer chambers. (See this issue.)

New Zealand.—WELLINGTON.—Post and Telegraph Department.
November 20th. Telephone cordage. (A.X. 10243.)*
November 25th. Rubber insulator rings. (A.X. 10298.)* Automatic table telephones. (A.X. 10295.)*
November 27th. Three-conductor switchboard cords. (A.X. 10369.)*
December 2nd. Automatic dials. (A.X. 10294.)*
December 9th. Telephone transformers. (A.X. 10370.)*
December 10th. Switchboard cable. (A.X. 10371.)*
December 15th. Transmitters. (A.X. 10362.)*
RANGIORA.—December 3rd. Borough Council. Truck-type switchboard. (A.X. 10372.)*
PUBLIC WORKS DEPARTMENT.—January 27th, 1931. 11,000-V switchgear and metering for Mangahao power scheme. (A.X. 10373.)*

Plymouth.—November 21st. Corporation. L.p. oil-immersed switchgear. (See this issue.)

Rochdale.—December 1st. Electricity Department. A.c. single-phase prepayment meters. (See this issue.)

South Africa.—PRETORIA.—November 21st. Department of Posts and Telegraphs. Dry cells and battery material. (A.X. 10244.)*
November 7th. Town Council. Induction voltage regulators. (A.X. 10360.)* Split-conductor cable. (A.X. 10361.)*
CAPE TOWN.—November 27th. City Electricity Department. Thirteen 3-phase transformers. (A.X. 10322.)*
KINGWILLIAMSTOWN.—December 2nd. Municipal Council Turbo-alternators, centrifugal pumps and switchgear. (A.X. 10353.)*
JOHANNESBURG.—November 20th. City Council. Paper insulated, l.c., armoured cable. (A.X. 10402.)*

St. Andrews (Fife).—November 5th. Town Council. Electric lighting of 84 houses. Specifications, &c., from Messrs. Walker & Pride, architects, Church Square, St. Andrews (deposit £1 1s.); tenders to town clerk.

Wakefield.—November 3rd. Installation of electric lighting at Adwick-le-Street, Woodlands Senior School. Education Officer, County Hall.

Warmley.—November 8th. Rural District Council. H.p. and l.p. cables with poles, switchgear and transformers. (October 10th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.

Contracts Closed.

Croydon.—Electricity Committee. Recommended :—
Three 200-kVA transformers (£517).—British Electric Transformer Co., Ltd.
Five oil switches (£190).—Ferguson, Pailin, Ltd.

Government Contracts.—The following contracts were placed by the various Government Departments during September :—

Admiralty Contract and Purchase Department.

Motor-alternators.—Haslam & Newton, Ltd.; Mackie and Co., Ltd.
W./t. amplifiers, tuners, receivers, &c.—Radio Instruments, Ltd.; Plessey Co., Ltd.
Electric cable boxes and covers.—Edison Swan Cables, Ltd.; Connolly's (Blackley), Ltd.; H. J. Baldwin and Co.
Paper-insulated cable.—Croydon Cable Works, Ltd.; Connolly's (Blackley), Ltd.
Electric fixed crane.—Thomas Smith & Sons (Rodley), Ltd.
Electric overhead travelling cranes.—Vaughan Crane Co., Ltd.; Joseph Adamson & Co.
Electrodes.—Quasi Arc Co., Ltd.; Alloy Welding Processes, Ltd.
Fans. — Electro-Dynamic Construction Co., Ltd.; Maudsleys, Ltd.; General Electric Co., Ltd.; Veritys, Ltd.
Generators.—Small Electric Motors, Ltd.; Haslam and Newton, Ltd.; Matthew Paul & Co., Ltd.; Drysdale and Co., Ltd.
Installation, electrical equipment for motor boats.—G. E. Taylor & Co.
Installation, electric light and mains.—Read & Partners, Ltd.
W./t. panels, &c.—Alfred Graham & Co., Ltd.; Radio Instruments, Ltd.; H. W. Sullivan, Ltd.
De-aerating plant.—W. H. Allen, Sons & Co., Ltd.
Pumps.—Worthington-Simpson, Ltd.
Electrically-driven saw..—A. Ransome & Co., Ltd.
W./t. valves.—Mullard Radio Valve Co., Ltd.

War Office.

Conduits.—Barton & Sons (1930), Ltd.
Electric cranes.—Herbert Morris, Ltd.
Mechanical stokers and air preheaters.—Edward Bennis and Co., Ltd.
Reorganisation of electricity supply, Wetley Hospital.—Metropolitan-Vickers Electrical Co., Ltd.

Air Ministry.

Accumulators.—Chloride Electrical Storage Co., Ltd.; Oldham & Son, Ltd.
Batteries.—C. A. Vandervell & Co., Ltd.
Battery-charging boards.—Park Royal Engineering Co., Ltd.
Indicating meters.—Weston Electrical Instrument Co., Ltd.
Motor-generator sets.—General Electric Co., Ltd.
W./t. valves.—Edison Swan Electric Co., Ltd.

Crown Agents for the Colonies.

Cable.—British Insulated Cables, Ltd.; Callender's Cable and Construction Co., Ltd.
Diesel engine.—English Electric Co., Ltd.
Electric motors.—Lancashire Dynamo & Motor Co., Ltd.
Fans.—Crompton Parkinson, Ltd.
" Lux " cells.—Chloride Electrical Storage Co., Ltd.
Overhead-line materials.—Bullers, Ltd.
Storage battery.—Batteries, Ltd.
Telephones.—General Electric Co., Ltd.
Wireless apparatus.—Marconi's Wireless Telegraph Co., Ltd.

Post Office.

Telephonic apparatus.—General Electric Co., Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones and Cables, Ltd.; Telephone Manufacturing Co. (1929), Ltd.
Wireless apparatus.—Standard Telephones and Cables, Ltd.
Dry batteries.—Ever-Ready Co. (Gt. Britain), Ltd.
Telephone cabinets.—Siemens Bros. & Co., Ltd.
Cable.—British Insulated Cables, Ltd.; Connolly's (Blackley), Ltd.; General Electric Co., Ltd.; Johnson & Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Enfield Cable Works, Ltd.
Instrument cords.—Reliance Electrical Wire Co.
Dynamotors.—Walter Jones & Co.
Fan and filter units.—Visco Engineering Co., Ltd.
Generators.—Bull Motors, Ltd.; Small Electric Motors, Ltd.
Electric handlamps.—Revo Electric Co., Ltd.
Electric lamps.—British Electric Transformer Co., Ltd.; British Thomson-Houston Co., Ltd.; Cryselco, Ltd.; Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; Siemens Electric Lamps and Supplies, Ltd.; Stella Lamp Co., Ltd.
Rectifiers.—Edison Swan Electric Co., Ltd.; Westinghouse Brake and Saxby Signal Co., Ltd.
Ebonite.—India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
Covered wire.—Macintosh Cable Co., Ltd.; Reliance Electrical Wire Co.
Replating batteries (Edinburgh central telephone exchange).—Hart Accumulator Co., Ltd.
Submarine cable (Stone Point-Gurnard Bay (Isle of Wight)).—Siemens Bros. & Co., Ltd.
Manufacture, supply, drawing-in and jointing of cable (Leeds-Huddersfield).—Pirelli-General Cable Works, Ltd.
Electric lifts (Leicester station sorting office, Darlington head post office, and Sheffield postmen's office).—W. Wadsworth & Sons, Ltd.
Power plant (Rugby radio station).—British Thomson-Houston Co., Ltd.
Telephone exchange equipment.—Stoneygate (Leicester multi-exchange area) : Siemens Bros. & Co., Ltd. Sub-contractors : English Electric Co., Ltd., for charging machines; Crompton Parkinson, Ltd., for ringing machines; Chloride Electrical Storage Co., Ltd., for batteries. Denton (Manchester automatic area) : Siemens Bros. & Co., Ltd. Sub-contractors : English Electric Co., Ltd., for charging machines; Chloride Electrical Storage Co., Ltd., for batteries. Woodley (Manchester automatic area) : Siemens Bros. and Co., Ltd. Sub-contractors : English Electric Co., Ltd., for charging machines; W. Jones & Co., for ringing machines; Chloride Electrical Storage Co., Ltd., for batteries. Winton (Bournemouth) : Automatic Telephone Manufacturing Co., Ltd. Sub-contractors : Electric Construction Co., Ltd., for motor-generators and ringing machines; Alton Battery Co., Ltd., for batteries. Longford (Manchester automatic area) : Standard Telephones and Cables, Ltd. Sub-contractors : Crompton Parkinson, Ltd., for charging machines; Chloride Electrical Storage Co., Ltd., for batteries. Solihull (Birmingham automatic exchange area) : Standard Telephones and Cables, Ltd. Sub-contractors : Crompton Parkinson, Ltd., for charging machine; Hart Accumulator Co., Ltd., for batteries. Heaton Moor (Manchester) : Standard Telephones and Cables, Ltd. Sub-contractors : Crompton Parkinson, Ltd., for motor-generators and ringing machines; Chloride Electrical Storage Co., Ltd., for batteries. Prestbury (Macclesfield exchange area), Macclesfield, Truro : Standard Telephones and Cables, Ltd. Sale (Manchester exchange area) : General Electric Co., Ltd. Sub-contractors : Crompton Parkinson, Ltd., for motor generators and ringing machines; D. P. Battery Co., Ltd , for batteries. Merton Abbey, Surrey (London exchange area) : Ericsson Telephones, Ltd. Sub-contractors : Electric Construction Co., Ltd., for motor-generators and ringing machines; Pritchett and Gold & E.P.S. Co., Ltd., for batteries.
Telephonic repeater equipment.—London : Fenny Stratford (extensions No. 4 and No. 5) ; Derby : Standard Telephones and Cables, Ltd.

H.M. Office of Works.

Wiring for Ministry of Labour, Kew.—Electrical Installations, Ltd.

Grimsby.—Electricity Committee. Recommended :—
L.p. cables (£9,998).—Metropolitan Cable & Construction Co., Ltd.

Langport.—Rural District Council. Accepted :—
Electric motor and accessories for the sewer flushing station at Somerton (£73).—Christy Bros. & Co., Ltd.

Liverpool.—Corporation. Accepted :—
Equipment for Clarence Dock power station.—Equalising pipes and pipes for the No. 2 turbine (£1,580).—John Spencer, Ltd.
Chimney drainage pipes (£2,371).—Markham & Co., Ltd.
Hydraulic couplings on the forced and induced draught fans (£4,423).—Babcock & Wilcox, Ltd.
Installation of switchboard at the new Stanley abattoir (£2,009).—Erskine, Heap & Co., Ltd., Manchester (sub-contractors of William Hall & Son, Ltd.)
Tramways; Electric Power and Lighting Committee.—Accepted :—
Twelve pairs of equal-wheel bogie trucks with flexible driving shafts, each bogie fitted with one D.K. 120 motor (£1,700 per pair); twelve car sets of electro-pneumatic control gear (£365 per car set).—English Electric Co., Ltd.
Tramway trackwork (£880).—Edgar Allen & Co., Ltd.
Public Assistance Committee. Accepted :—
Electric lamps.—General Electric Co., Ltd.

London.—Southwark.—Electricity Committee. Accepted :
Cables (£1,336).—Derby Cables, Ltd.
Meters (£123).—Measurement, Ltd.
Service boxes (£53).—H. Dunn & Son.
London County Council.—Housing Committee. Accepted :
Electrical installation in dwellings at Glebe Estate North, Camberwell (£1,490).—Hall & Stenson, Ltd.
Electrical installation in dwellings at Loughborough Estate, Lambeth (£1,067).—Saunders & Co.
Main Drainage Committee. Accepted :—
Northern outfall works.—Sludge pumping and drainage pumping sets (£1,814).—Mirrlees-Watson Co., Ltd.

Three steam turbine-driven blowers (£4,557).—Reavell and Co., Ltd.
Two electric generating sets, switchboard, &c. (£4,570).—Belliss & Morcom, Ltd.

Manchester.—Electricity Committee. Accepted :—
Supply of electric cookers for three months.—Revo Electric Co., Ltd.; Siemens Electric Lamps & Supplies, Ltd.; Jackson Electric Stove Co., Ltd.; Credenda Conduits Co., Ltd.
Single-phase fan motors for 12 months.—General Electric Co., Ltd.; Berkeley & Young, Ltd.; James Keith and Blackman Co., Ltd.
Flue gas washing plant for No. 13 boiler, Barton station.—Chemical Engineering and Wilton's Patent Furnace Co., Ltd.; sub-contractors for motors: Lancashire Dynamo and Motor Co., Ltd.
Airport Committee. Accepted :—
Electrical installation at airport hotel.—E. M. Evans and Son, Ltd.

South Africa.—CAPE TOWN.—Electricity Committee. Recommended :—
Street lighting fittings (£1,141).—S.A. General Electric Co., Ltd.
House service meters.—Associated Engineers Co., Ltd.
Replacing isolating links, &c., at switchboard (£711).—S.A. General Electric Co., Ltd.
Switchgear (h.p. £1,150, l.p. £1,181).—A. Reyrolle & Co., Ltd.
Motors.—S.A. General Electric Co., Ltd. (£552); Wilson and Herd (£371); Crompton Parkinson, Ltd. (£635).
Starters.—A. Vaux, Ltd. (£48); English Electric Co., Ltd. (£119).
1,000 100-watt Osram lamps (£206).—British General Electric Co., Ltd.

Stockport.—Town Council. Accepted :—
Electrical installations in 116 houses (£547).—John Collier and Co., Ltd.

Tynemouth.—Electricity Committee. Accepted :—
Cable (£755).—Macintosh Cable Co., Ltd.
Two six-way feeder pillars (£85).—British Insulated Cables, Ltd.
Two switchboards (£82).—J. H. Holmes & Co., Ltd.

West Lancashire.—Rural District Council. Accepted :—
Mains extensions in the Rufford district (£5,747).—W. T. Henley's Telegraph Works Co., Ltd.

Worcestershire.—Education Committee. Accepted :—
Installation of electric light at Hill Street school, Stourbridge (£78).—J. W. A. Devoy & Son.

Forthcoming Events.

Institute of Marine Engineers.—Friday, October 31st. Hotel Victoria, London. Annual conversazione.

Overhead Lines Association.—Friday, October 31st. Messrs. Harrods, Brompton Road, S.W. 8 p.m. Conversazione and supper-dance.

Salford Technical and Engineering Association.—Saturday, November 1st. Royal Technical College. 7 p.m. "Steam Turbines." Mr. A. T. Kersey.

Electrical Society of Glasgow.—Tuesday, November 4th. Reid's Smoke Room, 30, Gordon Street, Glasgow. 7.30 p.m. "Electrical Illumination as an Engineering Problem." Mr. W. J. Jones.

Royal Institution.—Tuesday, November 4th. Institution, 21, Albemarle Street, W. 5.15 p.m. "New Aspects of Radio-activity." Prof. C. D. Ellis.

Institution of Civil Engineers.—Tuesday, November 4th. Institution, Great George Street, S.W.1. 6 p.m. Opening address. Sir George William Humphreys.

Institution of Engineering Inspection.—Wednesday, November 5th. Connaught Rooms, Great Queen Street, W.C. Annual dinner and dance.

Royal Society of Arts.—Wednesday, November 5th. John Street, Adelphi, W.C.2. 8.30 p.m. Inaugural meeting. Chairman's address, "Britain's Record in India." Sir Edward Gait.

Institution of Electrical Engineers.—Thursday, November 6th. Institution, Savoy Place, Victoria Embankment, W.C. 6 p.m. "The Cooling of Electrical Machines." Mr. D. B. Hoseason.

(London Students' Section.)—Friday, October 31st. Institution, Savoy Place Victoria Embankment, W.C. 6.15 p.m. "Is the Engineer of To-day Making the Best Use of His Opportunities in Electrical Development in this Country?" Mr. H. T. Young.

(West Wales (Swansea) Sub-Centre.)—Friday, October 31st. Corporation Electricity Showrooms, Swansea. 6 p.m. Chairman's address. Sir A. Whitten Brown.

(Mersey and North Wales (Liverpool) Centre.)—Monday, November 3rd. Laboratories of Applied Electricity, the University, Liverpool. 7 p.m. "The Steam and Electric Power Plant of Imperial Chemical Industries, Ltd., at Billingham." Messrs. H. A. Humphrey, D. M. Buist, and J. W. Bansall.

(North Midland Students' Section.)—Tuesday, November 4th. Hotel Metropole, Leeds. 7.30 p.m. Chairman's address. Mr. I. H. Hedley.

North-Western Centre (Students' Section).—Tuesday, November 4th. Engineers' Club, Manchester. 7.15 p.m. "A Review of Power Station Operation." Mr. A. L. Lunn.

(Wireless Section.)—Wednesday, November 5th. Institution, Savoy Place, Victoria Embankment, W.C. 6 p.m. Chairman's inaugural address. Mr. C. E. Rickard.

(Meter and Instrument Section.)—Friday, November 7th. Institution, Savoy Place, Victoria Embankment, W.C. 7 p.m. Chairman's inaugural address. Mr. E. Fawssett.

Institution of Mechanical Engineers (North-Western Branch).—Thursday, November 6th. College of Technology, Manchester. 7 p.m. (Joint meeting with the I.E.E. North-Western Centre.) "Some Considerations in the Future Development of the Steam Cycle." Mr. K. Baumann.

Junior Institution of Engineers.—Friday, November 7th. Institution, 39, Victoria Street, S.W. 7.30 p.m. "Luminous Electric Tubes (Neon, Helium, &c.)." Mr. H. Marryat.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, November 7th. Mining Institute, Newcastle-on-Tyne. 6 p.m. "Feed Water Systems for Steam Installations." Mr. R. W. Allen.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following devices :—

Magnetic apparatus of an audible character used for testing steels.
DISTO fittings used for filling batteries with distilled water (a French patent).

Notes.

Swansea Hospital Heating.

The controversy over the heating of the Swansea and Merthyr Joint Mental Hospital at Swansea is by no means ended. The Joint Committee recently reversed a previous decision and by a narrow majority adopted a coal-fired boiler in the place of electrical heating. The Merthyr representatives voted solidly for coal, but the representatives of Swansea Corporation on the Committee are moving to get the matter reconsidered. The Swansea borough electrical engineer (Mr. J. W. Burr) has prepared a detailed reply to the statements made by Councillor Mainwaring Hughes who led the controversy for coal on the ground of lower cost. Mr. Burr points out that all estimates of costs in the report of the consulting engineer (Mr. Kiernan) are based on an accommodation of 900 and not 700 beds. It is fallacious, he says, to compare the cost of coal only as against the cost of electricity only. Electricity costs nothing to deliver, costs very little to use, and has other monetary advantages over coal-fired plant. A decision to use electricity at the hospital would not adversely affect the coal trade since a greater quantity of coal would have to be burned at the generating station than in the coal-fired hospital plant, and if it was decided to use coal-fired plant then the mental hospital would be tied for 20 years (the useful life of the plant) to an obsolescent plant instead of accepting the latest modern plant. "As the agreement for the supply of electricity to the mental hospital," he adds, "provides for the passing on to the consumer of any saving in the cost of generation, a substantial reduction in the cost of current can be confidently expected over a period of 20 years. I am of opinion that the equivalent price of coal delivered to the mental hospital over a period of 20 years would certainly average at least 29s. per ton if all the points raised are taken into consideration. Even if we take the figure of 26s. per ton I am convinced that over a period of 20 years the electrical method would show a substantial saving over coal-fired boilers."

In the event of the Joint Committee adhering to its decision to install coal-fired plant then a dispute is likely to arise when the contract comes to be placed and the Board of Control may be asked to decide the matter.

Electric Ship Propulsion.

In the course of his presidential address to the North-East Coast Institution of Engineers and Shipbuilders, at Newcastle-upon-Tyne, Mr. John McGovern stated, *inter alia*, that investigations now proceeding might result in giving a new lease of life to the steam prime mover; there would appear to be very considerable economies to be obtained by the use of high-pressure superheated steam plant, particularly for moderate and large power outputs, which had the advantage that conversion from oil to coal, or *vice versa*, might be made as the prices of the respective fuels rendered it desirable. Electric transmission had been adopted both for large and small powers, operated by steam turbines and internal-combustion engines. It made a strong appeal when the auxiliary load was considerable, either for "hotel" or cargo service; also when noiselessness, absence of vibration, or running at reduced powers and ease of manœuvring were of more than moderate importance. However, loss in transmission varied from about 15 per cent. in small installations to about 8 per cent. for large powers, as well as an increased weight and extra cost, compared with direct drive, all of which must be set off against the above-mentioned advantages. In the larger powers, both with geared turbines and turbo-electric transmission, the improved economies obtained were largely the result of progress made in high-pressure-boiler design and construction. He believed that the objections to water-tube boilers were being overcome, and that such installations would be more widely adopted in the future for turbine installations. The method of firing was naturally of considerable moment, and pulverised coal apparently offered a possible increase in efficiency.

Miss Amy Johnson and the Society of Engineers.

A large and distinguished gathering assembled at the Holborn Restaurant on October 21st, in connection with the dinner given to Miss Amy Johnson, C.B.E., by the Society of Engineers.

After Miss Johnson had been introduced by the president, Mr. W. M. Beckett, M.B.E., &c., and Rear-Admiral M. F. Sueter, R.N., C.B., M.P., she spoke for nearly an hour on the attention that she gave to the engine of her aeroplane during her famous flight to Australia. It was very clear from her speech that in addition to being a very capable air-women she has an extraordinarily complete and thorough knowledge of everything to do with the internal-combustion engine. Her own engine was an old one which had done some 36,000 miles before she took it over, and it is an extraordinary tribute to her powers of endurance to state that about five hours' work had to be done on the engine at every stopping place. The majority of this work had to be carried out by Miss Johnson herself owing to the total lack of any suitable labour in many districts.

The Fellowship of the Society of Engineers has been conferred on Miss Johnson. Appreciative speeches were also made by Dr. H. S. Hele-Shaw, LL.D., D.Sc., F.R.S., Hon. F.S.E., Viscountess Rhondda and Professor C. Vernon Boys, F.R.S., Hon. F.S.E.

The Institute of Fuel.

The fourth annual dinner of the Institute of Fuel was held on October 22nd at the Connaught Rooms, London, W.C.2 The chair was occupied by the president, Sir David Milne-Watson, and the company numbered about 500.

THE MARQUESS OF LONDONDERRY, K.G., P.C., M.V.O., proposing the toast of "The Fuel Industries," attributed much of the success of the Melchett-Turner conference to the president. The Institute of Fuel was engaged in research into the best methods of treating fuel, and particularly coal, which was in Great Britain the root of power and would remain in the future the root of its prosperity. We had been wont to rely on "muddling through," but now that the whole world was organised this policy would no longer serve.

SIR DAVID MILNE-WATSON, LL.D., D.L. (president), responding, stated that in his second year of office the membership of the Institute had increased by 35 per cent., and 90 students had been enrolled. The Melchett medal had been awarded to Dr. Rummell for his work in Germany by which a reduction of 15 per cent. had been made in fuel used in iron and steel works. The Institute was composed of representatives of many interests, but they concentrated on points of contact rather than on points of difference. The gas industry was increasing its output just as electricity was, and each had its own field; he advocated joint propaganda by the two industries. Sixty million pounds per annum was spent on imported oil and motor spirit; if proper support were given this amount could be appreciably reduced.

SIR WILLIAM LUKE, K.B.E., proposed "the Visitors." He pithily expressed the aim of the Institute as "the reduction in the use of fuel so that more fuel may be used."

MR. L. ST. L. PENDRED (president, I.Mech.E.) replied in a witty speech. LT.-COL. SIR ARNOLD WILSON, K.C.I.E., C.M.G. (chairman, Scientific Societies Joint Housing Committee), also replied. He said that a legal option on a suitable site for a building to house 12 institutions (of which three or four were of a non-scientific character) had been obtained. One-third of the total sum required had already been promised, and a banquet to inaugurate the scheme would be held on November 13th, at which the Prince of Wales would be present.

MR. FRANK HODGES, J.P., in proposing the health of "the President," mentioned his work in promoting peace in industry by his co-partnership policy. The president in his reply referred to the high qualities of the secretary of the Institute, Mr. P. C. Pope.

On the conclusion of the speeches a dance and cabaret entertainment were held. The function, which terminated at 1.30 a.m., was most enjoyable.

Proceedings of the Minister of Transport.

The applications to and proceedings of the Minister of Transport under the Electricity (Supply) Acts, 1882 to 1928, during the period April 1st, 1929, to March 31st, 1930, are dealt with in a report issued last week (H.M. Stationery Office, 6d. net).

The report refers to the financing of schemes (*e.g.*, N.E. Coast frequency standardisation and Bedford rural area), the regional schemes prepared for the Central Electricity Board, confirmation of special orders, consents for the erection of overhead lines, production costs of selected stations, scales of depreciation, sanctions to borrowing, and other matters coming under the Department, including the work of the Electricity Commissioners. Particulars of the more important cases have been given in the ELECTRICAL REVIEW from time to time.

The report states that during the period under review the Commissioners issued six consents relating to the establishment of new generating stations (three statutory and three non-statutory); 61 consents relating to the extension of existing generating stations (54 statutory and seven non-statutory); and 74 consents relating to the establishment of main transmission lines. The aggregate capacity of the generating plant sanctioned during the year was 292,838 kW. The Commissioners also approved 28 arrangements for the giving or taking of bulk supplies. The Minister also had under consideration a resolution passed by the Corporation of Newcastle-upon-Tyne and certain other public authorities, representing that the present state of the law with regard to the testing and certification of electricity meters is defective, and urging His Majesty's Government to introduce legislation requiring the certification and stamping of all electricity meters. After consultation with the Electricity Commissioners and a review of all the relevant points, and in the absence of evidence to show that there was any real ground for dissatisfaction on the part of electricity consumers, the Minister informed the authorities concerned that he was not satisfied that it was necessary or desirable to proceed at the present time with legislation, but that the position had been noted for re-consideration in connection with any future proposals which might be made for the amendment of the Electricity (Supply) Acts.

The Re-opening of Parliament.

The new session of Parliament was opened by the King in person on Tuesday last. The King's Speech made particular reference to unemployment. "I follow with grave concern and sympathy," said His Majesty, "the continuance of heavy unemployment among so many of my people. Economic depression unfortunately continues to dominate the markets of the world, and the accompanying restriction of international trade is felt with particular severity in those industries which are especially dependent on export. My Government will persist in its efforts to develop and extend home, Imperial, and foreign trade, and to help in measures which will lead to greater efficiency in industry."

The Speech also foreshadowed the setting up of a Royal Commission on Unemployment Insurance; and Bills for the taxation of land values; to amend the law relating to trade disputes and trade unions; to set up a Consumers' Council; to amend and consolidate the Factory Acts; and to establish a new statutory authority to deal with London passenger traffic.

The Plastic Moulders' Association.

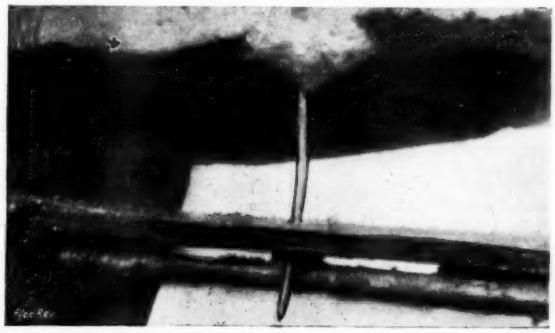
About one hundred members and guests attended the first luncheon of the British Plastic Moulding Trade Association at the Holborn Restaurant, London, on October 21st. MR. BERNARD WEAVER, chairman, explained that at similar subsequent luncheons the principal speaker would be invited to address them on some subject or other, not necessarily connected with the trade. On that occasion they had been fortunate in persuading one of their own members of Council, MAJOR T. KNOWLES (Graesser Monsanto Chemical Works, Ltd.) to comment on some of the impressions he had formed during a visit to Russia last year. During the usual votes of thanks it was suggested that similar luncheons might be arranged monthly, not as recruiting functions so much as to enable members to cultivate mutual acquaintanceship and assist the Council by suggestion and discussion. Theirs was a young industry, but they already had a journal of their own, and had secured a separate section at the British Industries Fair to avoid being scattered in various sections of the Fair. "If they did not hang together, they might each hang separately." MR. CLAUD TAYLOR (B.I.F.) remarked that the Association was a new comer to the Fair, which was now 16 years old. He would prefer not to have to deal with individual exhibitors, but with associations, which would reserve space on behalf of their members and arrange their own exhibits. The chemical industry and music trade had found that system to be successful, and the moulders now hoped to do likewise. In replying to the guests' toast, MR. CHILD (governing director of the Peetle Co., U.S.A.) conveyed greetings from the kindred association in America, which, he said, was formed about a year ago and had a membership of some 200.

Generation of Electricity.

The official returns rendered to the Electricity Commissioners show that 833 million kWh of electricity were generated by authorised undertakers in Great Britain during the month of September, 1930, as compared with 755 million kWh in the corresponding month of 1929, or an increase of 10.3 per cent. During the nine months of 1930 up to the end of September, the total amount of electricity generated by authorised undertakers was 7,721 million kWh, as compared with 7,291 million kWh for the corresponding period of 1929, representing an increase of about 5.9 per cent.

Interesting Cable Fault.

Mr. Frank R. C. Roberts, engineer and manager, Spalding electricity undertaking, has sent us the accompanying illustration depicting an interesting fault on the 11,000-V bulk-supply cable between Peterborough and Spalding. During road reconstruction works 12 months ago iron spikes were used to support the shuttering for the concrete work. The spike in question (with others) was not withdrawn, but was driven below road level. It seems, therefore, certain that this spike must have been in at least nine months. It had pierced the 2-in. creosoted "warning" board, the two layers of steel-tape armouring and the lead, and was separated from the copper core by the paper insulation only, and it is probably unique for the cable to have stood for such a long time under those conditions. The high-resistance fault caused the supply to be interrupted for 40 hours.



Spiked 11,000-V Cable.

Dunston "B" Power Station.

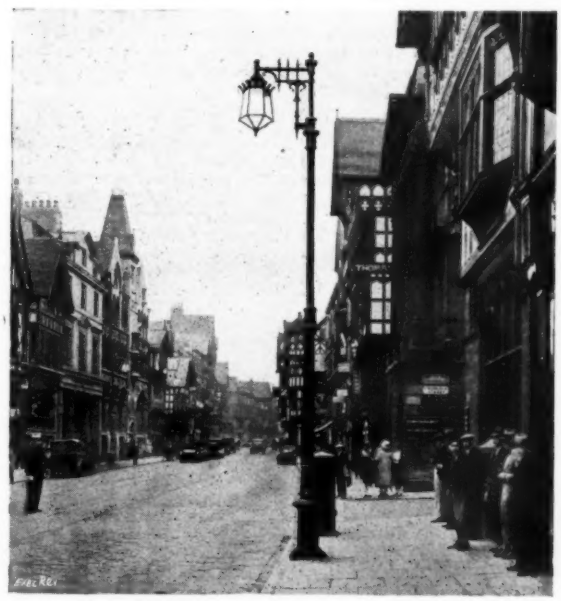
The Newcastle-upon-Tyne Electric Supply Co., Ltd., has at present under construction a new power station situated on the western side of the same site as the existing Dunston station. The new station will eventually contain six 50,000-kW generating sets arranged longitudinally in one turbine room. These sets will be supplied with steam from three separate boiler houses, each arranged at right angles to the engine room. The water for condensing and other auxiliary purposes will be drawn from the River Tyne by six electrically-driven vertical-shaft circulating water pumps situated in a pump house on the western extremity of the site. Gravity bucket coal-handling plant will be provided for elevating the coal as received to the overhead bunkers over the boilers, and a complete duplicate system of elevators will feed each boiler house, each elevator being capable of dealing with 75 tons of coal per hour. The first installation of the plant will consist of three 50,000-kW turbo-alternators, which have now been ordered from Messrs. C. A. Parsons & Co., Ltd., and one complete stoker-fired boiler house and one-half of a pulverised-fuel-fired boiler house. The general arrangement of the boiler plant will be four units in a line on each side of the boiler houses, with a central firing aisle. An order for half of these units has already been placed with Messrs. Clarke, Chapman & Co., Ltd., and the other half with Messrs. Babcock & Wilcox, Ltd. Some details of the boiler plant have already been given in our "Business and Industrial Notes." The turbines will be of the tandem type, consisting of one h.p. and one l.p. cylinder, the latter having one single exhaust. The initial steam pressure at the turbine stop valve will be 600 lb. per sq. in., superheated to 800 deg. F. After leaving the h.p. cylinder at a pressure and temperature of approximately 150 lb. and 525 deg. F., the steam will be returned to the boiler house and reheated to a temperature of 825 deg. F., after which it will be returned to the l.p. cylinder and finally exhausted to the condenser at a normal vacuum of 29 in Each turbo-alternator will be wound to generate 50-cycle current at 13,500 volts and will be complete with its own exciter driven as an extension to the main alternator shaft. The exciters will be completely enclosed and all voltage regulation will be carried out by a resistance in the exciter circuit. The order for the condensing plant has been placed with Messrs. Richardsons, Westgarth and Co., Ltd., and each condenser will have a cooling surface of 40,000 sq. ft. and will be so arranged on the water side that one-half of the condenser can be isolated for cleaning without necessitating a complete shut-down of the plant. The air-extraction plant will be of the contraflo jet system, and will consist of two complete installations (in duplicate), one being sufficient to deal with all the air with a normally tight system, and the other acting as a stand-by in case of breakdown, or as a supplementary extractor in case of abnormal air leakages occurring during operation. Connected to the terminals of each turbo-alternator will be a transformer stepping up the pressure to 66,000 volts, at which pressure the supply will be delivered to the company's system and to the Central Electricity Board. The main switchgear controlling the 66,000-volt circuits will be of the metal-clad type specially developed and manufactured for this station by Messrs. A. Reyrolle and Co., Ltd. It will have a rupturing capacity of 1,500,000 kVA. The whole of the electrical equipment of the power station will be remotely controlled from a central operating room.

Swedish H.P. Laboratory.

It is proposed to establish an institute for high-voltage research at the Uppsala University. The cost of the buildings is estimated at 325,000 kr. and that of the experimental apparatus at 99,500 kr. The annual expenses are calculated at 49,500 kr., and it is suggested that the State should defray the whole of the costs for a period of ten years.

Public Lighting in Chester.

Electricity was first used to light the streets of Chester in 1897, when 48 electric arc lamps were erected in the main streets leading from Chester Cross. The eleven years which followed saw all the public thoroughfares lighted by electricity, the number of lamps then being 197 arc and 745 incandescent electric lamps. In those days the street lighting was considered to be equal to that of any provincial town in this country. When it was found impracticable to obtain carbons suitable for the maintenance of the electric arcs during the war, they were replaced by metal-filament lamps, but owing to the difficulty of obtaining materials, the standard of illumination in the streets formerly lighted by arc lamps was not maintained. Since 1916 the question of discarding the electric tramcars has been under consideration and, as parts of the tramway and public-lighting equipment were used for both purposes, it was not expedient to improve the lighting in the main thoroughfares until the future of the tramcars had been settled. Having settled that question, no time was lost, and the last few days have witnessed the inauguration of the new system. The lanterns adopted in Eastgate Street, Northgate Street, Watergate Street, Foregate Street, Bridge Street, and Grosvenor Road have been specially designed to harmonise with the architectural character of those parts of the City, with a view to lighting effectively the street surface and the fronts of the buildings along those thoroughfares, thus enabling visitors to view the architectural beauties by night as well as by day. The equipment is an example of artistic discrimination combined with efficient illumination; entire absence of glare and uniformity of the light distribution display to advantage the beautiful old half-timbered buildings. The standard of illumination in Eastgate Street, Northgate Street, Foregate Street, of which a photograph is reproduced herewith, and Bridge Street is 0.5 foot-candle; in City Road, Brook Street, Frodsham Street, Boughton, Grosvenor Road, and Watergate Street 0.2 foot-candle, and in other thoroughfares leading to the borough boundaries 0.1 foot-candle. Special attention has been paid to the lighting of Grosvenor Bridge by means of six 5-light pillars of distinctive and elegant design. The city electrical engineer, Mr. S. E. Britton, M.I.E.E., M.I.Mech.E., and the Revo Electric Co., Ltd., are responsible for the installation.



New Lighting Standard, Chester.

Kinema Lighting.

Some novel features in electric lighting have been included in the new Paramount Kinema, Manchester, which was formally opened recently. Various styles of concealed lighting have been adopted for the auditorium, the mezzanine ceiling, stalls, and foyers. The outstanding feature, however, is that the wiring and control are so arranged that three separate and distinct colours can be used, either individually or for colour blending. The total loading of the lighting installation is about 500 kW, representing an illumination of the order of 1,000,000 c.p.

Institution Notes.

Institution of Electrical Engineers.

The first meeting of the 1930-31 session was held on October 23rd. Col. Sir T. F. Purves, the retiring president, announced the awards of premiums for papers read before the Institution and its Wireless, Meter and Instrument, and Students' Sections, some of which were presented that evening while others were reserved for presentation at local Centres. Mr. C. C. Paterson, the incoming president, then took the chair, and called upon Lt.-Col. K. Edgcumbe to propose a vote of thanks to the past president, which was seconded by Mr. J. S. Highfield, and replied to by Sir Thomas Purves.

The presidential address was then delivered (see p. 753 of this issue) accompanied by demonstrations of gaseous sources of light. Dr. A. Russell proposed a vote of thanks, which was seconded by Mr. P. V. Hunter, supported by Sir Richard T. Glazebrook, and acknowledged by Mr. C. C. Paterson. The meeting was crowded and a loud-speaker relaying installation had been provided in case of an overflow into the common room.

Tea was served in the library, which has been re-opened after the modernisation of the lighting system, the provision of an extra gallery and book shelves at one end, and new floor covering.

Tees-side Sub-centre.—In his address on October 22nd as chairman, Mr. H. G. A. Stedman, superintendent of the southern area of the Newcastle-on-Tyne Electric Supply Company, pointed out that an analysis revealed that only 16 kWh were lost through failures out of every million kWh sold. That alone justified the title of his address: "The Security and Reliability of Electricity Supply"; his object was to direct attention to the many factors involved and the immense amount of time, thought, and money expended in ensuring as reliable a supply as was possible.

Detailed reference was made to the various kinds of breakdowns which had to be guarded against and the best methods to adopt in minimising breakdowns and getting them readjusted when they did occur. Lantern slides were used to illustrate typical faults, the effect of earth movements on underground cables, &c. Particular stress was placed on the need for a highly trained staff, and the directions in which research should be carried on.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. G. W. Maxfield, charge engineer at the Carlisle electricity works, has resigned to take up another appointment. The Electricity Committee, in view of the development of the undertaking, has reorganised certain appointments, and has decided that **Mr. H. P. Baynham** shall be re-designated deputy chief electrical engineer, and that **Mr. E. M. Nuttall,** of Newton Abbot, shall be appointed charge engineer.

M. F. Lucien J. Jumau, of the Compagnie Générale d'Electricité, of Paris, one of the leading French authorities on accumulators, has recently been appointed a Chevalier of the French Legion of Honour.

Mr. J. R. M. Elliott, M.I.E.E., who, as we recently reported, is retiring from the position of superintending engineer, Northern District, of the General Post Office, was the guest of honour at a gathering of representatives of all ranks in his district held at the County Hotel on October 11th. Over 200 were present including Sir Thomas Purves, engineer-in-chief of the G.P.O., and Mr. F. G. C. Baldwin occupied the chair. During the evening Sir Thomas Purves presented Mr. Elliott with a silver tea and coffee service and a handbag for Mrs. Elliott.

Mr. John Harley, of the mains records staff of the Yorkshire Electric Power Co., has been appointed mains records draughtsman to the West Midlands Joint Electricity Authority, Wolverhampton.

Mr. S. B. Jackson, A.M.I.E.E., has been appointed regional control engineer of the South-East England Scheme of the Central Electricity Board and he is leaving the staff of the North Metropolitan Electric Power Supply Co. Mr. Jackson was intending to stand for Parliament, but in view of his new appointment he has abandoned that intention.

Mr. Frank H. Whysall, city electrical engineer and general manager of the Belfast Electricity Department, whose portrait accompanies this note, is the 1930-31 chairman of the Irish Centre of the Institution of Electrical Engineers. Mr. Whysall received his technical education at the School of Art, Rotherham, and the Technical School, Sheffield, while his practical training was obtained with the Midland Iron Co., Ltd., Rotherham, and the Sheffield Electric Light & Power Company with whom he served a five years' indentured apprenticeship. His early positions were those of engineer-in-charge in Sheffield and resident engineer of the Dickinson Street and Bloom Street power stations, Manchester. In 1914 he was appointed chief engineer and manager of the Greenock Electricity Department, leaving there to take up his present position in 1927. During his period of office as resident engineer with Manchester Corporation, Mr. Whysall read a paper before the Institution of Electrical Engineers entitled "The Use of a Large Lighting Battery in connection with Central Station Supply," for which he was awarded the Ayrton Premium in 1913. As burgh electrical engineer of Greenock Mr. Whysall carried out many important extension schemes, including the supply of electricity to the neighbouring towns of Gourock and Port Glasgow under Provisional Orders acquired from them. Mr. Whysall was secretary and vice-president of the original linking-up committee for the West of Scotland, and as he subsequently inaugurated a bulk supply of electricity from Greenock to Paisley in 1924, he may claim to have taken a notable part in effecting the interconnection of the West of Scotland 50-cycle undertakings, which is now an accomplished fact. During Mr. Whysall's three years in Belfast the progress of the undertaking has been very rapid. The energy sold per head of population has increased from 77 to 127 kWh; bulk supplies have been given to the towns of Lisburn, Holywood and Bangor; and valuable assistance has been given to the Government of Northern Ireland by Mr. Whysall's Department in connection with the Government's schemes for electrical development. Mr. Whysall was to deliver his address in Dublin yesterday (Thursday).

Lafayette, Manchester.

Mr. F. H. Whysall.
Chairman of the Irish Centre of the I.E.E.

Mr. Edgar Cox-Walker, of Cox-Walkers, Ltd., Darlington, was recently married to Miss E. W. Todd of the same town.

Mr. John S. Just, the Queensland consulting engineer, has removed to Commonwealth Bank Building, Queen Street, Brisbane. (Box 1067 N, G.P.O., Brisbane.)

Mr. J. C. Harbord, chairman of the board of the Radio Corporation of America, was a passenger on the *Aquitania* when she left the United States on October 22nd.

Mr. N. V. Everton, London manager for the Lamp Sales Department of the Metropolitan-Vickers Electrical Co., Ltd., has been appointed sales manager for that Department. His office will be at Bush House (West Wing), Aldwych, W.C.2, the London headquarters of the Metropolitan-Vickers Electrical Co., Ltd.

Obituary.

Lt.-Col. S. W. Neale.—We regret to hear of the death of Lt.-Col. S. W. Neale, V.D., who has been associated with Mr. H. A. Neale in business for the last 15 years, in the firm of H. A. Neale & Co., electrical engineers and contractors, High Holborn, W.C.

Mr. F. Starkey.—The death occurred in the Western Infirmary, Glasgow, on October 24th, of Mr. Frederick Starkey, of Messrs. Heenan & Froude, Ltd., as the result of injuries sustained in a motor accident in which two other men were killed.

Herr K. Hoheisel.—The death recently occurred in Vienna, only a few weeks after his retirement, of Herr Konrad Hoheisel, general director of the Austrian Posts and Telegraphs.

Mr. R. B. Weaver.—We learn with regret of the death, on October 20th, of Mr. Robert Beresford Weaver, manager of the Wireless Department of the General Electric Co., Ltd. A few months ago Mr. Weaver had a very serious illness, but he appeared to have fully recovered from this, for he was very active in connection with the recent Radio Exhibition. At the close of the Exhibition, however, he went into hospital; there he suffered a recurrence of his ailment from which he failed to recover. He was 55 years of age and had been associated with the G.E.C. for 36 years. Mr. Weaver was very popular in the radio industry, and despite the heavy demands made upon him by his own immediate business, found time to devote to furthering the interests of the industry as a whole. He was vice-chairman of the old National Association of Radio Manufacturers and Traders and, later, served for a time as vice-chairman of the Radio Manufacturers' Association and chairman of the Membership Committee of that body.

The funeral took place on Friday last week at Twickenham. Among those present were Mr. S. D. White, Mr. H. W. Roberts, Mr. L. C. Gamage, and Mr. C. Wilson (directors of the G.E.C.), Mr. C. Pinkham, Mr. G. A. Marriott, Mr. T. W. Heather, Mr. M. M. McQueen, Mr. C. Luvati, Captain J. W. Barber, and many representatives of the radio industry. A large number of floral wreaths were sent by his colleagues and business friends.

The late Mr. R. B. Weaver.
Manager of the Wireless Department of the G.E.C.

Wills.—The late **Mr. George G. Sim,** C.I.E., C.S.I., who was deputy-chairman of Vickers, Ltd., and Vickers-Armstrong, Ltd., left personal estate valued at £38,957.

Mr. Joseph W. Wilson, the late principal of the Crystal Palace School of Engineering, left estate valued at £12,317 (£12,227 net personalty).

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares.

New Companies Registered.

Erling Bold, Ltd.—Private company. Registered October 24th. Capital, £100 in 2s. shares. Objects: To carry on the business of mechanical, wireless, telegraph or telephone, electrical, motor or experimental engineers, dealers in electrical, mechanical and wireless apparatus, gramophones, &c. The subscribers are: Irene M. Hutton, 191, Sellincourt Road, S.W.17, clerk; Vera A. Osborne, "School House," Fircroft Road, Upper Tooting, S.W.17, clerk. J. C. Lawrence (director of National Automatic Machines, Ltd.) is the first director. Registered office: National Provincial Bank Chambers, Tooting Broadway, S.W.17.

Miller Electrical Organisation, Ltd.—Private company. Registered October 24th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers and repairers of and dealers in electrical, mechanical, rubber, leather, wood and metal goods, advertising signs, wireless instruments, &c. The directors are: F. Mi[illegible] J. A. MacKinnon (addresses not stated); F. P. Timmons, 81, Selwood Road, Addiscombe, Croydon. Solicitors: Kenneth Brown, Baker, Baker, Essex House, Essex Street, W.C.2.

Wembley Relay Service, Ltd.—Private Company. Registered October 22nd. Capital, £2,000 in £1 shares. Objects: To construct and maintain wireless signal and receiving stations, to carry on the business of electricians, radio engineers, &c. The directors are: W. H. Shipley, 117, Westbourne Avenue, Hull, general engineer; A. Wallis, 117, Wellesley Road, Clacton-on-Sea, radio manager. Registered office: 25, Elford Grove, Harehill, Leeds.

Super Radio Co., Ltd.—Private company. Registered October 25th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of, dealers in and agents and factors for the sale and purchase of electrical and other instruments and appliances in connection with wireless telegraphy and telephony, electrical and scientific instruments, &c. The first directors are: H. S. Freeman, 24, Ullet Road, Liverpool; F. S. Freeman, "Bronwydd," Sandfield Park, Liverpool, wireless dealers (both permanent). Registered office: 32, Withy Grove, Manchester.

Muta Signs, Ltd.—Private company. Registered October 23rd. Capital, £5,500 in 5,000 10 per cent. cumulative preference shares of £1 each and 5,000 ordinary and 5,000 deferred shares of 1s. each. Objects: To acquire from J. P. Naylor his rights for Great Britain and Northern Ireland in respect of "Universal" electric signs. The permanent directors are:—J. P. Naylor, 57, Croxted Road, Dulwich, S.E.21, inventor; H. S. Laycock, Crossways, Roxwell, Essex, advertising agent. Registered office: Room 112, Grand Buildings, Trafalgar Square, W.C.2.

Richard W. Foote, Ltd.—Private company. Registered October 23rd. Capital, £100 in £1 shares. Objects: To acquire the business carried on by R. W. Foote at 120, Holland Park Road, W.11, and to carry on the business of manufacturers of and dealers in lamp shades, accessories, electrical fittings, &c. The directors are: R. W. Foote and Grace E. Foote, 462, Uxbridge Road, Shepherds Bush, W.12. Secretary: D. S. Gregory. Registered office: Cross Keys House, 56, Moorgate, E.C.2.

Official Returns of Electrical Companies.

W. G. Hodgson & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated May 23rd, 1930. 800 shares taken up. £400 paid. £400 considered as paid. Mortgages and charges, nil.

British Electric Meters, Ltd.—Capital, £50,000 in £1 shares. Return dated June 13th, 1930. 22,000 shares taken up. £14,650 paid. £7,350 considered as paid. Mortgages and charges, nil.

Express Magneto (Repairs) and Electrical Co., Ltd.—Capital, £2,000 in 1,500 cumulative preference shares and 500 ordinary shares of £1 each. Return dated June 27th, 1930. 1,300 preference and 450 ordinary shares taken up. £1,750 paid. Mortgages and charges, £950.

Hightensite (1930), Ltd.—Particulars filed of £10,000 debentures authorised October 17th, 1930, charged on freehold land, factory, &c., in West Ham, and the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Electrical Wiring Investment Co., Ltd.—Charge on freehold property known as "The Chestnuts," Forest Row, Sussex, with house, &c., thereon, dated September 23rd, 1930, to secure £700. Holder: Mrs. A. Tipples, The Homestead, Cranbrook, Kent.

Radio Instruments, Ltd.—Charge on lands, buildings and hereditaments in Purley Way, Croydon, known as Radio Works, dated October 16th, 1930, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Shardlow Electric Wires, Ltd.—S. I. Wallis, 3, King John's Chambers, Bridlesmith Gate, Nottingham, was appointed receiver and manager on October 10th, 1930, under powers contained in instrument dated October 1st, 1930.

Burgess Hill and District Electric Supply Co., Ltd.—Debenture charged on lands and premises at Burgess Hill, and the company's goodwill, undertaking and other property, present and future, dated October 7th, 1930, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd.

Boroughbridge and District Electric Supply Co., Ltd.—Satisfaction in full on September 23rd, 1930 (1) of debenture for £2,000 and (2) debenture for £1,000, both dated October 1st, 1929, and registered October 9th, 1929.

Harrison & Searle, Ltd.—G. Haring, Queen's College, Paradise Street, Birmingham, was appointed receiver and manager on October 15th, 1930, under powers contained in mortgage debenture dated February 20th, 1929.

Accurate Recording Instrument Co., Ltd.—C. G. Wareham, 199, Piccadilly, W., was appointed receiver and manager on October 18th, 1930, under powers contained in debentures dated April 4th, 1930.

Walsh & Stevenson, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital and goodwill, dated October 7th, 1930, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

East Suffolk Electricity Distribution Co., Ltd.—Capital, £50,000 in £1 shares. Return dated May 19th, 1930. 38,000 shares taken up. £38,000 paid. Mortgages and charges, £20,000.

Synchronola Radio Co., Ltd.—Capital, £400 in 317 ordinary shares of £1 and 1,660 deferred shares of 1s. each. Return dated June 26th, 1930. 252 ordinary and 1,660 deferred shares taken up. £102 paid on 77 ordinary and 500 deferred shares. £233 considered as paid on 175 ordinary and 1,160 deferred shares. Mortgages and charges, nil.

Allite, Ltd.—M. G. Chant, 70a, Basinghall Street, E.C.2, was appointed receiver on September 30th, 1930, under powers contained in debentures dated March 15th, 1929.

Edmundsons' Electricity Corporation, Ltd.—Particulars filed of £1,000,000 debenture stock, with liberty to issue further stock up to an aggregate amount not exceeding one-half of the paid-up share capital, authorised by resolutions of June 27th and July 1st, 1930, and covered by trust deed dated October 7th, 1930, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,000,000. Trustees: Premier Investment Co., Ltd., Dashwood House, Old Broad Street, E.C.

W. T. Glover & Co., Ltd.—Capital, £214,850 in 100,000 preference and 114,850 ordinary shares of £1 each. Return dated June 9th, 1930. All shares taken up. £117,000 paid. £97,850 considered as paid. Mortgages and charges, nil.

W. H. A. Robertson & Co., Ltd.—Capital, £36,000 in 3,000 preference and 600 ordinary shares of £10 each. Return dated July 11th, 1930. 2,180 preference and 600 ordinary shares taken up. £25,650 paid (being £5 per share on 430 preference and £10 per share on 1,750 preference and 600 ordinary). Mortgages and charges, £600.

Contraflo Engineering Co., Ltd.—Capital, £43,725 in 16s. 6d. shares. Return dated May 30th, 1930. 53,000 shares taken up. £43,725 considered as paid. Mortgages and charges, nil.

Asea Electric, Ltd.—Capital, £5,000 in £1 shares. Return dated June 4th, 1930. All shares taken up. £5,000 paid. Mortgages and charges, nil.

Ilfracombe Electric Light and Power Co., Ltd.—Capital, £50,000 in £5 shares. Return dated April 28th, 1930. 7,000 shares taken up. £35,000 paid. Mortgages and charges, nil.

British Electric Transformer Co., Ltd.—Capital, £1,000,000 in 300,000 preference and 700,000 ordinary shares of £1 each. Return dated August 20th, 1930. 300,000 preference and 325,000 ordinary shares taken up. £539,821 paid on 290,776 preference and 249,045 ordinary shares. £85,179 considered as paid on the remainder. Mortgages and charges, £20,000.

Birmingham and District Investment Trust, Ltd. (formerly Birmingham District Power and Traction Co., Ltd.).—Capital, £2,239,120 in 1,119,560 6 per cent. cumulative redeemable preference and 1,119,560 ordinary shares of £1 each. Return dated June 9th, 1930. 1,119,560 ordinary shares taken up. £559,780 paid. £559,780 considered as paid. Mortgages and charges, £221,451.

City Notes.

Ferranti, Ltd.

The 1929-30 report of this company was reviewed in our last issue (p. 700). The annual meeting was held on October 21st, when Mr. V. Z. de Ferranti (chairman), who presided, made reference to the death of his father, Dr. S. Z. de Ferranti, and of Mr. A. W. Tait, who was chairman of the company for 20 years. He briefly reviewed the pioneering work carried out by the late Dr. de Ferranti, and then dealt in some detail with the financial results of the past year. He mentioned that investments in subsidiary companies showed a rise of £47,198, due to further capital taken up in the Canadian company, raising the total investment in it to £67,198. The additional capital was required by the Canadian company for the purpose of erecting and equipping a new works at Mount Dennis, Toronto. Referring to the scheme of re-arrangement of the company's capital, sanctioned by the Court this year, Mr. de Ferranti pointed out that £200,000 of the reserve had been capitalised and issued in the form of 10s. ordinary shares. The company's authorised capital now consisted of 500,000 7 per cent. cumulative preference shares of £1 each and 800,000 ordinary shares of 10s. each. An issue of 250,000 preference shares had been made after the date of the balance sheet. To illustrate the pre-eminent position held by the company in the lines which it manufactured, the chairman said that it was constructing three 80,000-kVA transformers for the Battersea station of the London Power Co., which were the largest units yet constructed in this country, if not in the world. The Central Electricity Board had placed in their hands the metering of the electricity supplied from the grid to distributors in the South-East England area, and had ordered from them 76 per cent. of its largest transformers of 60,000 kVA and 75,000 kVA capacity. Their water heating and electric fire business was expanding, and they claimed that their radio apparatus was the standard for comparison in the radio world. In conclusion, the chairman paid a tribute to the company's staff.

Erinoid, Ltd.

The annual meeting was held on October 21st, Mr. W. G. Waldron presiding. In presenting the report and accounts, the chairman said that having regard to the conditions which had obtained during the last five months, the results were satisfactory. The profits for the first half of the year were slightly better than those of the corresponding period of 1929, but the profits of the last five months did not equal those of the corresponding five months of 1929. The decrease in sales was due to the general depression in trade. Their material was largely used in the "luxury" trades, and general trade depression was apt to hit them more quickly and more severely than other classes of manufacture. Had it not been for the unsettled outlook and general depression at home and abroad, they might have risked paying a dividend, but at present it was uncertain what the course of business was going to be. The report and accounts were adopted.

Western Union Telegraph Co.

The report for the first nine months of the current year shows gross revenues of $102,056,635, as compared with $111,163,667 for January-September, 1929. The total expenses decreased from $96,844,124 to $91,753,804, and the net income from $11,611,995 to $6,594,924.

Herbert Morris, Ltd.

The trading profit for the year ended July 31st last was £58,827, as compared with £95,414 in the previous year, and after adding interest from investments and the amount brought in a total of £123,377 is available. It is proposed to pay a final dividend of 5 per cent. on the ordinary shares, making 10 per cent. for the year, against 15 per cent., and to carry forward £51,849.

Jerusalem Electric & Public Service Corporation, Ltd.

The first report of this company states that the construction of the power station and laying of mains were commenced in January, 1929, and these were sufficiently advanced to enable a supply to be given to consumers on November 3rd. According to the *Financial Times*, since the closing of the accounts the works have been fully completed and handed over to the company, the contractors continuing to operate the plant on behalf of the company until November 3rd, 1930. The balance of revenue account carried forward is £P1,723, subject to the remuneration of directors and auditors.

Electric Supply Co. of Victoria, Ltd.

The gross profits to March 31st last totalled £67,179, against £71,422, and the total credit balance was £87,370 (£87,132). A dividend of 10 per cent. is paid on the ordinary shares (same), and £41,474 is carried forward. An agreement for the transfer of the undertaking to the State Electricity Commission has been ratified by the Victorian Parliament.

Young Accumulator Co. (1929), Ltd.

This company's first report, covering the sixteen months ended August 31st last, shows that after meeting expenses and depreciation there is a loss of £28,774. It is stated that certain manufacturing difficulties were encountered in the new works; these have now been overcome and working costs have been reduced. Substantial orders are being secured.

Drake & Gorham, Ltd.

The report for the year ended June 30th last records a net profit of £9,511 (against £8,220 in 1928-29); to this is added £3,040 brought forward, making £12,551. The dividend is maintained at 5 per cent., £2,500 is again placed to reserve, and the balance (£3,801) is carried forward. Owing to the increased demand for the company's h.p. switchgear a site was acquired and new works were erected at North Acton. These are now in full production and an increased production at lower costs have resulted. The installation at Lloyd's Bank head office has been completed and further extensions have been made at Harrods' Stores. Among other new contracts the company has been awarded the order for the electrical work at the Masonic Peace Memorial building. It is expected that during the coming year a larger staff will be employed by the company at the Bank of England with a consequent addition to turnover. The meeting is to be held to-day (Friday).

Amazon Telegraph Co., Ltd.

The report for the year ended June 30th last shows a gross revenue, including a profit of £940 realised on investments, of £46,152, and working expenses of £31,289. After providing for debenture interest, &c., there is a debit balance of £8,408, which, added to the debit balance of £5,031 brought forward from the previous account, leaves £13,439 to be carried forward. Meeting: November 4th.

Glenfield & Kennedy, Ltd.

An interim dividend is announced on the ordinary capital of 4 per cent., less tax.

Ever Ready Company (Great Britain), Ltd.

The directors have declared interim dividends at the rate of 10 per cent. per annum on the preference shares, and 10 per cent. actual on the ordinary shares. They report the continued expansion of the business since April 1st, 1930; sales were substantially in advance of the corresponding period of the previous year.

Haslam & Newton, Ltd.

The directors have announced that as the accounts for the year ended September 30th last are not yet completed, they do not feel justified in paying the half-year's dividend, due November 1st, at the present time, and have therefore decided to postpone payment.

Tata Hydro-Electric Power Supply Co.

The net profit to June 30th last was Rs. 23,47,722, as compared with Rs. 16,41,203. The ordinary dividend is maintained at 7 per cent., tax free, and Rs. 2,25,703 is carried forward.

Andhra Valley Power Supply Co.

The net profit to June 30th last was Rs. 13,78,071, and after deducting depreciation on investments, &c., and paying a dividend of 3 per cent. on the ordinary shares, Rs. 2,12,071 is carried forward.

Stocks and Shares.

Tuesday Evening.

Business in the Stock Exchange markets shows signs of improvement. Members of the House say that there are more inquiries reaching them than actual orders, though it is admitted that the latter give indications of increase. That there is a certain amount of public demand can be gauged from the fact that prices in most departments show sensible advances over last week, while, as compared with the levels reached only three weeks ago, there are notable recoveries from the lowest values then touched. It is difficult to indicate any concrete reason for this change in sentiment. Forced selling has come to an end. In various directions, trade pointers suggest that business is slowly struggling to its feet. Gilt-edged stocks retain most of their recent strength, though according to generally credited report, a good many people are selling their 5 per cent. War Loan and replacing the stock with good-class investments that stand a better chance of capital appreciation.

Investment Stocks.

London Electric Railway 5 per cent. debenture stock has risen ¼ to 2⅝ premium, and the Central London 5 per cent. debenture to 2¾ premium. The fully-paid stocks stand at 102¼ and 102½, respectively. The July issue of this same stock, which carries an interest payment of £1 6s. 8d. on January 1st, as compared with the 10s. per cent. on the October stock, is changing hands on the basis of 103¼. Edmundsons' Electricity has further soared to 6½ premium; Newcastle-on-Tyne debenture holds its rise at 6 premium. The G.E.C. 5 per cent. debenture is nearly a point higher at 2¾ premium. Amongst other new shares which have improved in price, Midland Counties shares may be mentioned as having strengthened to 3s. premium. Scottish Power new shares are better at 1s. premium.

Dealings have started this week in the 5 per cent. redeemable debenture stock recently offered at 98½ by the Yorkshire Electric Power Company. Of the £550,000 which was issued, underwriters were called upon to take up about 17 per cent. of their obligations. The price of the scrip is 102; that is to say, 3½ premium above the issue price. It is obvious that a certain number of the company's stockholders failed to take advantage of the opportunity offered them for acquiring first-rate stock at a reasonable figure. Philips' Incandescent Lamp Works is offering 5 per cent. debenture bonds at about 99½. The stock is to be convertible into shares at 400 florins. The issue is being made on the Continent, partly in Holland, partly in Switzerland. Possibly a further issue will be made later in this country. The price of the shares has receded to 2 5/16.

West Midlands Fives.

Of gilt-edged stocks which are available, the supply is now exceedingly small. Central Electricity 5 per cent. stock has gone into the hands of the permanent investor. There is £10,000 West Midlands Joint Electricity 5 per cent. stock, 1948-1968, on offer at 102, free of stamp and fee. Interest is payable on April 1st and October. The security is as sound as the yield—£4 18s. per cent.—on the stock is modest. West Gloucestershire 5½ per cent. debenture is 2 points up at 101½.

Tube Railway Stocks.

The Underground Electric Railways Company of London has privately issued £2,000,000 5 per cent. debenture stock, ranking *pari passu* with the existing 4¾ millions of the same stock. The money is required partly in order to pay off the 6 per cent. bonds that fall due for redemption early in March next. The price of the company's shares has risen 1s. to 24s. The 5 per cent. debenture stock already issued is quoted at 101, interest payments being due in May and November.

The prices of London Tramway shares have undergone no changes. London & Suburban ordinary were sold a few days ago at 2s. 1½d., and the preference at 10s. 9d. The company's 4½ per cent. first mortgage debenture stock changed hands at 76½ in August, and the "A" debenture stock was last dealt in at 93½ in April this year. Metropolitan Electric Tramways 5 per cent. preference stand at 12s. 3d., London United Tramways ordinary at 6d.

Metropolitan consolidated stock remains at 71. Districts rose ½ to 75½, in sympathy with the strength displayed by Home Railway stocks as a whole. A very little buying sufficed to lift the prices of the steam stocks, and in substantial manner. Investors, it is found, are still chary as a whole of putting money in Home Rails, though the Tube stocks are regarded as being in a different category.

Telegraphs and Telephones.

The better tendency amongst industrials, of which mention has been made above, is reflected in the strength shown by the Cables and Wireless group. The prices of the two senior issues have risen about 3 points apiece, the preference having improved to 71½, the 7½ per cent. "A" ordinary to 25½. Speculative investment is responsible for the rise in the price of the former. A good deal of business is being done in the trio, but the narrowness of the market is shown by the fact that an order for £5,000 stock may easily influence a price to the extent of a point or more. Other stocks and shares in the group are steady. The Amazon Telegraph Company,

whose £10 shares are quoted at 30s., though the last bargain marked in them was at 15s. a month ago, shows an addition of £8,400 to the debit balance brought forward from last year. The debit now comes to £13,439. The company's 5 per cent. debentures stand at 100. American Telephone & Telegraph at 205 is virtually unchanged on the week, while International Telephones, after undergoing sharp fluctuations, are 2½ higher, at 32¼. Constantinople Telephone shares remain flat at 2½, and the 6 per cent. obligations at 80. There has been a little inquiry for the pre-ordinary stocks of the Eastern Cable group, and Eastern Telegraph 4 per cent. debenture stock has strengthened to 77, the company's 3½ per cent. preference to 63. The 4 per cent. mortgage debenture stock of the Eastern Extension Company stands at 75½. Oriental Telephone shares at 2¾ are ex the dividend of 9 3/5d. net deducted from the price last week.

Home Electricity Supply Shares.

Business is limited in the list of Home Electricity supply shares by the scarcity of supply rather than by any unwillingness on the part of the investor to take a hand in the business. Improvements that have taken place this week include Midland Counties, which have risen a florin to 28s., and Electrical Distribution of Yorkshire, which are 9d. up at 35s. 9d. The ordinary shares of half-a-dozen different companies are each 6d. higher. County ordinary are 9d. better at 47s.

Demand continues to seek preference shares in the electricity supply group, only to find, however, that it is a good deal more easy to sell shares than it is to buy them. The Hendon Electric Supply Company is offering its shareholders 50,000 6 per cent. cumulative preference shares of £1 each at 20s. 9d. These shares are to rank in all respects with the existing preference shares as from the middle of next month. The market price of Hendon preference is 21s. 6d. middle, which includes nearly six months' dividend. Folkestone Electricity 5 per cent. preference are quoted at 17s. 6d. Electrical Finance and Securities 7 per cent. preference strengthened to 22s. 6d. ex dividend. The ordinary shares have advanced to 45s., and the 5½ per cent. debenture is quoted at 96¼ xd. Llanelly and District 6 per cent. preference are 18s. 9d. middle. Business was done early this week in the ordinary shares at 15s. 6d. London Electric 6 per cent. preference, of £5 each, are up 2s. 6d. at 5¾. Small improvements have been secured by Shropshire preference, Midland Counties preference and Scottish Power preference, all of them being harder at 23s. 6d. Westminster Electric preference at 18s. have put on 1s.

Australian and Indian Issues.

The New South Wales elections, which have resulted in a victory for the Labour Party, brought about heavy falls in the prices of Australian stocks and shares. But no alteration has occurred in Melbourne Electric Supply ordinary, the nominal price of which is 160. The last date upon which a bargain was marked is March 10th this year, when stock changed hands at 176. The Indian issues show rather more firmness than they have been doing of late. Calcutta Tramways ordinary and preference are both 11s. 3d. Madras Electric Trams preference are somewhat nominal at 10s. Rangoon Tramways preference maintain their ground at 19s. 6d. Singapore Traction ordinary are quoted at 6s. 3d., the 7 per cent. preference at 18s. Calcutta Electric Supply ordinary, which went ex dividend last week, are called 44s. 6d., and Delhi Electric Supply Traction ordinary 31s. 3d.

Manufacturing Companies.

The feature in the list of electrical equipment shares is a rise of 5s. in Henley's ordinary, the price improving to 6¼. There is a firm tendency as a whole in this group. G.E.C. ordinary further improved to 46s. 3d. Associated Electrical Industries shares at 23s. 6d. have responded to a mild demand for the shares from New York. The American market is disposed to be rather better, and the acute flatness which overtook the group a fortnight ago has given place to more cheerful conditions.

Brazilians and Americans.

Brazilian Tractions recovered 2 points, rallying to 28, though the preference remain weak at 90. The news from Brazil is held to indicate that the revolution is nearly over, the *coup d'etat* being successful so far as the deposition of the previous President is concerned. San Paulo Tramway 5 per cent. debenture stock regained 3 points at 83¼. Rio Tramway 5 per cent. 50-year mortgage bonds at 87 are 3½ up. Other Brazilians have recovered in similar manner. Shawinigan Water at 55½ is 2½ points better. Power Corporation of Canada at 56 is a dollar down. Pennsylvania Water at 67½ shows no change on the week. Radio Corporation shares have been an active market. Atlas Trust are a better market at 24s.

Miscellaneous Matters.

The Ever-Ready Company has declared an interim dividend of 10 per cent., which is accompanied by the intimation that sales to date are substantially in advance of those in the corresponding period of the previous year. The price of the shares improved to 18s. 9d. Drake & Gorham's profit of £9,511 for the year ended June 30th last is about £1,300 up. The ordinary shares will again receive 5 per cent. dividend. English Electric preference are 1/16 higher at 10s. The engineering group retains its firmness. Rubber shares show no particular changes, although the price of the commodity is harder, at 3/16d. per lb.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Approx. Dividend. 1928.	1929.	Price Oct. 28 1930.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	57/6	—	5 4 4
Brompton Ordinary	1	8½	8½	26/6	—	5 5 8
Charing Cross Ordinary	1	8½	8½	28/-	—	5 0 0
do. do. 4½% Pref. ...	1	4½	4½	18/-	—	5 0 0
Chelsea	1	8½	8½	27/-	—	5 3 9
City of London	1	10	10	38/9	—	4 8 1
do. do. 6% Pref....	1	6	6	23/6	—	5 2 2
Clyde Valley	1	8	8	37/-	– 6d.	4 6 6
County of London	1	7	10	47/-	+9d.	4 5 1
do. do. 6% Pref....	1	6	6	24/-	+6d.	5 0 0
Edmundson's 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	11	47/-	—	4 18 7
Kensington Ordinary	1	8	8	27/6	+6d.	5 1 10
Lancs. Light and Power	1	7½	7	24/6	+6d.	5 14 8
London Electric	1	8½	9	30/6	+6d.	4 11 10
Metropolitan	1	9	10	2⅛	—	4 16 10
do. 4½% Pref.	1	4½	4½	17/-	—	5 6 0
Midland Counties	1	6½	7	28/-	+2/-	5 0 0
Mid. Elec. Power	1	15	8	30/9	—	5 4 1
Newcastle-on-Tyne Ordinary ...	1	6	6	23/-	—	5 4 4
do. 7% Pref.	1	7	7	26/6	—	5 5 8
Notting Hill 6% Pref.	10	6	6	10⅜	—	5 11 4
North Met. Elec. 6% Pref....	1	6	6	23/6xd	+6d.	5 2 2
St. James' and Pall Mall	1	8	8	28/-	—	5 0 0
Scottish Power	1	8	8	29/-	+6d.	5 10 4
South London	1	8½	8½	27/-	—	5 3 8
Urban Ordinary	1	7	7	29/6xd	+6d.	4 15 0
Westminster Ordinary	1	8½	8½	28/-	—	5 0 0
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	24/6	—	6 2 5
Yorkshire Elec.	1	8	8	32/-	—	5 0 0

Home Rails.

Central London Ord. Assented ...	Stock	4	4	78	—	5 2 7
Metropolitan	,	3½	4	71	—	5 12 8
do. District	,,	4	5	75½	+⅜	6 12 5
Underground Electric	£1	7	8	24/-	+1/-	6 13 4
do. do. Income ...	Bonds	6	6	104	–1½	5 15 5

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	102xd	—	5 17 8
do. Def.		1½	1½	2⅜	—	6 0 0
Automatic Telephone	1	10	12½	33/9	—	7 8 4
Cables & Wireless 5½ Pref.... ...	Stock	—	5½	71½	+3	7 13 10
do. A 7½ Ord.		—	—	25½	+3	... ...
do. B Ord.	,,	—	—	14	+1½	... ...
Globe Tel. and T. Ord.	10	10	10	14½	—	*6 18 0
do. do. Pref.	10	6	6	10⅜	—	5 11 7
Great Northern Tel.	10	20	20	30	—	6 13 4
Marconi-Marine	1	12½	15	8⅜	—	8 11 6
Oriental Telephone Ord.	1	12	12	25xd	—	*5 1 1

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	1⅞	—	14 13 4
do. do. 2nd Pref. ...	5	6	6	1⅜	—	17 3 0
do. do. 5% Deb. ...	Stock	5	5	52½	—	9 10 6
British Electric Traction Def. Ord.	,,	5	5	1325	– 50	... ...
do. do. Pref. Ord.	,,	8	8	123½	—	6 6 6
Brazil Traction	100	7	8	28	+2	... ...
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	93½	+1	5 8 1
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	11/-	—	... ...
London United Tram Deb. ...	Stock	4	4	52½	—	7 12 4
Mexico Trams, 5% Bonds	—	5	5	57	—	8 15 6
Mexican Light Common	100	Nil	Nil	57½	—	... ...
do. 7% Pref.	100	7	7	75½xd	—	9 5 8
do. 1st Bonds	—	5	5	78	–1	6 6 7
Victoria Falls Ord.	1	15	15	58/-	—	5 3 5
Yorkshire (West Riding		Nil	Nil	5/-	—	... ...

Manufacturing Companies.

Assoc. Elec. Ord.	1	6	6	23/6	+1/-	5 2 2
Babcock & Wilcox	1	13	15	52/6xd	—	*5 14 3
British Aluminium Ord.	1	10	10	35/-	–⅛	5 14 3
British Insulated Ord.	1	15	15	3⅞	—	4 7 3
Brush Ord.	Stock	10	10	105	—	9 10 6
Callenders	1	15	15	3¼xd	+9d.	4 10 8
do. 6½% Pref.	...	6½	6½	25/-	—	5 4 0
Crompton Parkinson Ord.	5/-	—	80	20/-	—	7 10 0
do. 8% Pref.	1	8	8	26/3	—	6 2 0
Edison-Swan 1st. Pref.	1	7½	7½	23/9	—	6 6 4
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	5½	5	12/-	—	8 6 8
Enfield Cable Ord.	1	20	25	4¾	—	5 17 9
English Electric	1	Nil	Nil	11/8	—	... ...
do. do. Pref.	1	8	Nil	10/-	+⅛	... ...
Ferranti Pref.	1	7	7	20 3	—	6 18 3
Gen. Elec. Pref.	1	6½	6½	24/9	—	5 5 2
do. Ord.	1	10	14	46/3	+6d.	6 1 4
Henley	1	25	30	6¼	+¼	4 16 2
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	7/6	—	... ...
Johnson & Phillips	1	10	10	18	—	5 6 8
Siemens Ord.	1	7½	7½	1⅛	—	7 1 2
Telegraph Construction	12	10	10	19	—	*6 6 7

* Dividends paid free of Income Tax.

Installation Materials for France.

A Review of the Conditions and Prospects in the French Market for Contractors' Supplies.

IN our issue of October 17th we reviewed two reports on Continental markets for domestic electrical appliances prepared by the Department of Overseas Trade and made brief mention of a third report closely allied to these, *viz.*, a study of the French market for electrical contractors' supplies. This report naturally traverses a good deal of the ground covered in that dealing with the domestic appliance market in France, but it contains far more detail regarding the nature of the accessories required by French contractors. As before, it is stated that the bulk of the requirements are met by French manufacturers, but neighbouring countries are finding an outlet for their products in this expanding market, and it is considered that there is no reason why British manufacturers should not be able to sell their goods in France. At present British materials of the class in question are practically unknown in France, although, in general, British products enjoy a high reputation.

Methods of Procedure.

The report states that British firms desirous of entering the market should either appoint agents in France or send out representatives who speak French fluently, carry catalogues and, if possible, samples. Such representatives should be able to indicate the weights and measurements of their goods in the metric system and to quote prices in French francs c.i.f. French port, or, better still, French destination. Prior to the visit of the representatives, the British firm's goods might be advertised in the country. Business is usually carried on through wholesalers or agents. In order to obtain appreciable results, it would seem necessary to open a depôt in Paris from which articles in current demand could be supplied to local agents. The British Consul at Lille states that the rate of commission on sale is 5 per cent. with perhaps a fixed monthly allowance. The usual terms of payment are 30 days after the end of the month of the dispatch of goods, with 2 per cent. discount, or sometimes net with 90 days' credit to houses of good financial standing. It is reported that German exporters offer special credit facilities.

Those firms which have already obtained a foothold in the French market should carry out publicity campaigns in all districts where there is likely to be a demand for their goods. British firms who have not yet entered the French market would perhaps do well, in the first instance, to appoint an agent in Paris having sub-agents or travellers in the provinces. The Paris and Lyons Fairs are extensively patronised by the great electrical firms: British firms would do well to exhibit at these Fairs (also at the Lille and Bordeaux Fairs) as part of their publicity campaign. If representatives were sent to France to explore market possibilities, they would be well advised to call on British Consular officers in the district in order to ascertain the names and addresses of likely purchasers of electrical supplies.

Conditions in Various Districts.

Specific districts are dealt with in the report by the British Consular officers concerned, and it is of interest to learn the comparative penetrability of these districts from the British manufacturers' point of view. As regards the capital, conditions do not appear to be favourable. Although the market is a very extensive and expanding one opportunities for British manufacturers are small owing to the supremacy of French suppliers, although glassware, in which we cannot compete, is imported to a considerable extent. Only extra low prices or unusually high quality will find an entry for British goods. It is mentioned parenthetically that certain tumbler switches of superior quality and special make are imported from England. Such openings as exist are in the direction of ceiling roses, lampholders, switches, plugs, &c., of high quality. It is considered that there is no real prospect of introducing wires and cables (except perhaps small rubber-covered wire) or fuses and distribution boards. There is still business to be done in special lines and in the better-class goods, but it has to be sought for and fostered. Generally speaking, the difficulties in the case of British articles are not of a technical nature but economic and commercial. High prices of British goods, overproduction on the part of the French industry, increasing competition above all from Germany, and what appears to be a merely half-hearted interest in the market and the character and circumstances of the customers, all make it exceedingly difficult for British goods to make any headway, in spite of the increasing demand for electrical supplies. Foreign competitors, who have the enormous initial advantages of lower prices, are, moreover, going after whatever business can be got away from French manufacturers in a most energetic manner, and are, in addition, adapting themselves to the French character and circumstances far more than are the majority of the British.

So much for Paris, but similar conditions seem to prevail in some other important districts. In Marseilles and Lyons, for instance, the price factor is again evident although there is an appreciation of British quality. In the case of Rouen the heavy duties on electrical supplies are mentioned as a factor militating against British trade. A schedule of these duties is appended to the report. In the Strasbourg area German influence is very strong and such materials as are not supplied by French manufacturers come from over the border.

A Gleam of Hope.

The Consular officers at Le Havre and Lille hold out hope for the British supplier, and their reports are therefore worthy of a separate paragraph. The Consul at Le Havre, indeed, goes so far as to say that there is not only a possibility, but every indication, in the direction of an increase in British imports owing to a general growth in the demand. British goods are used in the district to a considerable extent, and in cases where they are not imported directly they are supplied through French firms with offices in Paris. "No criticism has been heard in regard to any unwillingness shown by British exporters to fall in with the requirements, tastes, or methods of importers, dealers or retailers of this district. British goods are sold in considerable quantities in the Consular district of Havre, and their quality and durability is recognised and appreciated, so there would appear to be no special recommendation to be made on this score, except that genuine electrical novelties of household importance do not appear to be sufficiently emphasised, and it would be useful for makers to intensify their advertising of such lines. It might be advantageous for British electrical material to be exhibited at next year's Havre Trade Fair. . . . . British manufacturers who have no agencies or branches in France should not hesitate to send travellers to this Consular district for the purpose of visiting dealers and soliciting orders, partjcularly as local dealers are quite prepared to consider novelties and improved materials."

The Lille Consul's opinion that there is scope in his district for British goods appears to be based on the success of German, American, Dutch, Swiss, and other suppliers. He says that "it certainly would seem that British manufacturers could find a sale for their products if they would take the trouble, particularly as the industrial north, apart from being so close to England and attached to it with so many ties, has similar industries (coal-mines, metallurgic and textile factories). This is the view of, amongst others, the principal local importer, M. Eugene Gros, Passage de la Fontaine-del-Saulx, Lille, whose turnover last year is reported to have amounted to 36 million francs, and who, since commencing business in 1907, has not even seen a British engineer or traveller, yet he would very much like to do business with England, towards which country, partly as a result of his war service, he is very well disposed." The Consul suggests that, failing an individual visit and study of the market, interested British suppliers could not do better than communicate with M. Gros; or they might ask the Consulate to approach likely agents, furnishing the necessary materials.

Standards and Requirements.

Wiring regulations are published by the Union des Syndicats d'Electricité, 25, Boulevarde Malesherbes, Paris, and it is understood that they are strictly adhered to. Lead-covered, steel-conduit and ordinary rubber-insulated wiring systems are said to be equally popular. In ordinary house installations wood casing is employed. Meters have to secure the approval of the Ministry of Public Works. Porcelain ceiling roses appear to be generally employed and tumbler switches are in more common use than the rotary type. Domestic lampholders are usually of the bayonet type, although screwed sockets are used in the Strasbourg area as well, as a legacy from the time of German influence. In this district, too, rotary switches are general. Wall plugs and sockets are principally of the two-pin type, there apparently being no requirements as to the earthing of domestic appliances; the pins are generally set wider apart than is usual in English types.

In conclusion, it may be mentioned that during the past five years British exports of electrical goods and apparatus (excluding machinery and switchgear) to France have been in the neighbourhood of £250,000 per annum.

The Marking of Imported Meters.

A Merchandise Marks Act Inquiry.

As we indicated last week, an application by the British Electrical and Allied Manufacturers' Association, under the Merchandise Marks Act, 1926, for an Order-in-Council requiring that imported electricity meters and certain parts should bear marks indicating their origin, was the subject of an inquiry, held at the Board of Trade offices, on October 20th and 21st. The evidence was not completed by the end of the second day, and consequently it was resumed on Monday last. **Sir Hubert Ll. Smith,** K.C.B., is the chairman of the Standing Committee which conducted the inquiry. The B.E.A.M.A. made the application on behalf of ten meter manufacturing members, and three meter manufacturers who are not members. The member companies were the Aron Electricity Meter, Ltd., British Electric Meters, Ltd., British Insulated Cables, Ltd., the British Thomson-Houston Co., Ltd., Chamberlain & Hookham, Ltd., the Edison Swan Electric Co., Ltd., the Electrical Apparatus Co., Ltd., Ferranti, Ltd., the Metropolitan-Vickers Electrical Co., Ltd., and the Reason Manufacturing Co., Ltd. The non-member firms were Fox & Offord, Ltd., Measurement, Ltd., and Smith Meters, Ltd. The production of these companies, it was claimed, represented 90 per cent. of the output of meters in this country. The Incorporated Municipal Electrical Association and the Incorporated Association of Electrical Power Companies supported the application.

The specific meter parts which it was asked should be marked, in addition to meters imported complete, were the case, the rotor, the shunt system, and the series system. Magnets were not included in the application because they were already the subject of a marking Order. Gears and counters were also excluded as they were imported not only for use in electricity meters, but for many other purposes, and differentiation would be very difficult.

The application was opposed by the Electrical Importers' and Traders' Association on behalf of five firms. Four of these firms were members—the A.E.G. Electric Co., Ltd., John Godden & Co., Robert Hornby & Co., Ltd., and Thompson and Co. These were all importers of meters or parts, and Messrs. Thompson, it was stated, had commenced to manufacture meters in this country. The fifth company was Landis and Gyr, Ltd. (not a member of the Association), who, besides manufacturing meters in this country, was interested in the importation from Switzerland of special types of meters and parts which were well known as specialities of that country. The company was gradually introducing the manufacture of those items into this country, and was installing new plant at its Acton factory for the purpose. It was claimed that Landis and Gyr, Ltd., and Thompson & Co. were in a position similar to most of the applicant firms, who, while manufacturing meters in this country, utilised therein one or more imported parts. It was claimed on behalf of the opponents that electricity meters were invariably sold in an expert market, so that rarely was confusion likely to arise as to their origin. Further, it would be specially inopportune to require the marking of imported parts at this moment, because the opponent firms who were progressively increasing manufacture in this country, in substitution for meters and parts previously imported, would be hampered during the change-over period. Another argument was that if marks were applied to imported parts incorporated in meters which were in the main manufactured here, it would be assumed that the meters as a whole were foreign. In certain instances, also, the marking proposed by the applicants would result in injury to the parts.

Mr. Cyril Atkinson, K.C. (leading counsel for the B.E.A.M.A.) asked that, if the marking Order were made, it should require the meters and parts to bear indications of origin at the time of importation into this country as well as at the time of sale or exposure for sale, because once they were admitted into the country without marks it would be difficult, and in some cases impossible, to prove their origin if attempts were made to evade the marking requirements. Discussing the extent of importation, he said that 103,824 meters were imported in 1928 and 115,944 in 1929. The value of parts imported in 1928 was £64,080, and in 1929 £58,871. In the first six months of 1929 the value of imported parts was £24,141, and there had been an increase to £43,294 for the corresponding period of 1930. Although some of the opponents had said that they were using fewer imported parts, the figures showed that, generally speaking, that could not be true. Dealing with the suggestion that all meters were sold in an expert market, he said it was true that the main buyers were the electricity supply authorities, but it was idle to suppose that the majority of the buyers on behalf of these authorities were very expert in judging the origin of meter parts. Indeed, in many cases experts could not determine whether a part was British or foreign Meters were also bought, however, by industrial concerns for checking the electricity consumption in their various departments; by contractors concerned with the building and equipment of flats; by exhibition organisers for measuring the consumption of the various stands; by hotel proprietors for measuring the electricity consumption of heaters in bedrooms; and so on. The application included prepayment meters. An Order limited to complete meters might not protect the purchaser of a meter assembled from imported parts in the United Kingdom, and for this reason it was asked that the parts specified should also be marked. There were meters made wholly in this country, others which were wholly imported, and others which purported to be made here but contained imported parts. Very often meters bearing English names contained foreign parts.

It was asked that the indications should be indelibly die-stamped or engraved on the front cover of each meter or on a metal plate securely fastened to the front of it; that cartons, boxes or other containers in which meters or parts were packed should be marked; that parts should be indelibly stamped or engraved; that meters containing two or more imported parts in respect of which a marking Order was made should be marked, in the same way as a meter imported complete, but with the words "foreign parts"; and that crates, packing cases, &c., should be marked.

Mr. R. Amberton, M.I.E.E. (director of the Electrical Apparatus Co., Ltd., and vice-chairman of the Meter Section of the B.E.A.M.A.) gave evidence. After supporting the statement as to the difficulty, and in some cases the impossibility, of determining the origin of a meter or parts by looking at it, he said that, speaking generally, the British meter had been rather larger and more robust than the foreign meter in the past, but the tendency in recent years had been towards greater similarity. Regarding the suggestion that the marking of parts would entail hardship upon manufacturers in this country who used some imported parts, he said that the manufacturers who supported the application, in so far as they used imported parts, were quite prepared to bear such burdens as the marking requirements might impose. He disagreed with the suggestion that in some cases the marking proposed would involve injuring the meters or parts. It had been stated, for example, that the stamping of the thin disk of the rotor would disadvantageously affect the properties of the meter, *e.g.*, the shunt running, as it would create certain harder places in the material which would result in destroying the eddy currents in the disk; further, that the impression would give an unequal torque for the different positions of the rotor in the gap of the magnetic system; and that such consequences would in effect amount to a prohibition of importation. That statement, he said, was exceedingly far-fetched; the rotor could be stamped in parts outside the range of eddy currents. The statement with regard to marking affecting the torque was also far-fetched.

In reply to **Mr. N. L. Macaskie,** K.C. (counsel for the opponents), witness said that his company imported gears, but it had recently found two sources of British manufacture, and in the near future it would not be necessary to import them. Questioned as to the possibility of affecting the accuracy of a meter through the marking of the rotor disk, he said the best position for the mark would depend upon the design of the rotor. He said that in mass-produced articles the cost of marking would be very small.

Mr. A. M. Sillar, M.Inst.C.E. (past-chairman of the Association of Consulting Engineers, and chairman of the Committee on Electricity Meters of the British Engineering Standards Association), said that he had acted as electrical engineer to the Treasury in regard to expenditure of the Trade Facilities Act Loans and in that capacity had had to certify that so far as was possible purchases made with those loans had been manufactured in this country. At times he had ascertained that meters which he had believed to be entirely British contained foreign parts, and that other meters which he had understood were made in this country were in fact made sometimes in this country and sometimes abroad. It was his experience that meter purchasers among the smaller supply undertakings, public institutions, works, estates, &c., were frequently not fully alive to the fact that they were supplied with apparatus manufactured abroad. Where meters were of foreign design and were manufactured entirely or in part both in this country and abroad, he would be quite unable to determine the place of manufacture if there were no distinctive marking. This applied also to parts manufactured abroad and inserted in British meters. He was authorised by the Association of Consulting Engineers to state that this expressed the view of the majority of its members.

In the course of cross-examination he agreed with Mr. Macaskie that a borrower of money under the Trades Facilities

Acts had to certify what proportion of the goods he bought with that money was British. He agreed also that the borrower would demand a certificate from the supplier, unless he were under the impression that he was purchasing British goods and did not consider it necessary to obtain a certificate. That impression, however, might be wrong.

Mr. Macaskie said he was instructed that firms which supplied foreign meters to persons who were purchasing with the assistance of an advance under the Trade Facilities Acts gave a declaration as to the origin of the meters in every case. Mr. Sillar replied that such a declaration had to be asked for when a foreign firm was supplying. In reply to the chairman he said that in all the meters he knew of there was a "safety spot" to which the indications of origin could be applied without affecting the accuracy of the meters. Questioned further by Mr. Macaskie as to the possible restriction of importation as a result of marking, he said the last thing the applicants desired was that people should be prevented from buying foreign meters if they wanted to buy them.

Mr. R. H. Schofield (general sales manager, Ferranti, Ltd.) supported the previous evidence. Dealing with the suggestion that the marking of meters and parts in the manner proposed by the applicants would add materially to the cost, he said that, assuming a meter contained an imported case, rotor, shunt system, and series system, the total cost of marking those parts in the manner proposed would be less than 2d. per meter. The cost of marking disks, he had ascertained, was about a farthing each.

In the course of cross-examination Mr. Schofield was questioned as to the marking of a rotor disk and its possible effect upon torque. In consequence of this he had a meter tested in his company's laboratory in London, and at a later stage of the inquiry he gave the results. A meter was tested with the disk unmarked; the disk was then removed, marked with the word "foreign" by means of a punch, and replaced, after which the meter was again tested. The engineers who had carried out the test reported that there was no observable difference as the result of the marking.

Other witnesses on behalf of the applicants were **Mr. T. A. G. Margary** (borough electrical engineer, Wolverhampton); **Mr. E. M. Fawssett** (chief engineer, Testing Department, Newcastle-upon-Tyne Electric Supply Co., Ltd., chairman of the Meter and Instrument Section of the I.E.E., and chairman of a panel of the Meter Committee of the B.E.S.A.); **Mr. W. Lawson** (who is in charge of the Meter and Motor Department of the Birmingham electricity supply undertaking); and **Mr. R. S. Downes** (general manager and engineer to the Brompton and Kensington Electricity Supply Co., Ltd.).

A question put to some of the witnesses by the chairman was whether they would object to applying the marks to rotor disks by painting or etching intead of by stamping or engraving. Mr. Lawson said that he would have no objection to a painted mark, provided the paint used was non-magnetic. Mr. Schofield said that for marking large quantities of disks he would recommend etching or engraving rather than stamping; etching would be cheaper than stamping, and painting would be cheaper still.

The Opposition Evidence.

Mr. L. R. Lester (director of Landis & Gyr, Ltd., Acton) was the first witness called on behalf of the opponents. It had been the company's intention since its factory was erected, he said, to manufacture meters complete, and it had progressively taken over more and more of the manufacturing processes, though there must be a transition period during which certain of the parts of meters, and in some cases complete meters, had to be imported from Switzerland. For some years past the company had manufactured one class of meter almost entirely (the only exception being the counters and bearings), and had partially manufactured others. By the end of 1930 one further class of meter would be British manufactured to the same extent as the one first mentioned, and others would follow in the course of the next year. The great bulk of the importation of parts of meters into this country was at the instance of the applicants themselves.

Mr. Lester's evidence corroborated the opponents' statement of objections, which has been referred to. He denied that, except in isolated cases, consumers purchased or installed meters of their own for domestic use, it being very much more economical to hire the meters. Apart from sales to electricity undertakings, his company sold almost entirely to electrical contractors and factors, and in both cases the effective purchaser was almost always an expert, and able to distinguish between British and foreign meters and parts. Emphasising the point that marking parts by means of stamps would give rise to inaccuracies in the working of the meters, he referred, by way of example, to some laminated metal strips used in the shunt system. These were made of special iron, which was very hard; in order to make a mark discernible, very heavy pressure would have to be used, and that amount of pressure would damage it. Further, the material was so treated by the manufacturers that a scale was formed on the surface of the iron, and punching would damage the scale. Once the scale was broken it was liable to chip off and find its way into the magnetic gap. With regard to prepayment meters, he said that in the majority of cases the mechanism came from abroad; prepayment meters consisted of foreign parts to the extent of 50 per cent., and the use of these meters was growing rapidly.

Mr. Atkinson, cross-examining, referred to some meters which were imported by Landis & Gyr, Ltd., from Switzerland, and sold without marks; he presumed it was the desire that buyers would assume that they were produced by the company. Mr. Lester replied that his firm had to do a certain amount of work on all the meters. He agreed that the only information regarding origin which the buyers had was that given to them by his firm. He maintained that the marking of parts would prejudice sales. In this connection he said it was the practice for some firms to build switchboards, complete with meters, and sell the switchboards as being of British manufacture. If such meters contained one or two foreign parts, which parts had to be marked, the makers of the switchboards would not buy the meters. It was difficult to define what was a British manufacture; even the Board of Trade could not define it.

Bearing in mind witness's statement that meters were sold in an expert market, Mr. Atkinson asked if it were now suggested that buyers were likely to think that, because a meter contained some marked parts, it was wholly foreign. Mr. Lester said they might think so if the meter was definitely labelled "foreign." He also referred to export difficulties, and said that British goods exported to Australia must be accompanied by a declaration that they were 75 per cent. British, if they were to obtain the advantage of the preferential tariff. If such a declaration were made in respect of meters bearing an indication that they contained foreign parts, endless difficulties would arise with the Customs authorities. With regard to the marking of the laminated strips used in the shunt system, Mr. Atkinson pointed out that one of these strips which had been exhibited at the inquiry had holes bored through it. Having ascertained from witness that they were bored before the strips were finished, he urged that marks could be applied at the same time.

Some little amusement was caused when Mr. Lester, questioned as to his contention that British and foreign meters were distinguishable, selected from a number of meters one which he said was of typically German finish. Mr. Atkinson said that it was made in London.

Mr. Robert Hornby (managing director of Messrs. Robert Hornby & Co., Ltd., selling agents in Great Britain for electricity meters manufactured by Siemens-Schuckertwerke, G.m.b.H., at Nürnberg, Bavaria) was the next witness. He said that all the meters imported by his company bore metal labels indicating their origin, and were sold with the labels attached. It was unnecessary for imported parts to bear indications of origin when assembled into a complete meter which itself was marked. He referred to difficulties that he said he had experienced with some of the electrical papers in connection with the advertising of meters under the name "Siemens-Schuckert." Mr. Hornby corroborated the previous evidence as to the high cost of marking parts and the injury which would arise from marking.

The inquiry was resumed on Monday last, October 27th.

Mr. Hornby gave further evidence, and stressed the point that he did not object to marking meters, but was anxious that the driving parts should not be damaged by marking. Tests which he had carried out indicated that the accuracy of the meters was affected to the extent of 2 per cent. by marking. The marking of parts would seriously interfere with the production processes at the Siemens-Schuckert factory in Bavaria; the cost would be increased by 7 or 8 per cent. Under the present system there were produced at the factory 560 meters per employé per annum, as against 135 per employé per annum in the applicants' factories.

Mr. Slade (counsel for the applicants) assured Mr. Hornby that if the marking Order were granted, it would not be necessary to mark the separate parts in meters which were imported complete, and would bear a mark of origin on the case. Therefore, if the Order were made, Messrs. Hornby could continue to sell their meters exactly as at present.

The Chairman said that, in order to make the matter clear, parts included in marked meters imported complete would have to be definitely excluded from the marking requirements.

Mr. Slade suggested that the statement that the marking of parts would affect the accuracy of meters was a red herring drawn across the trail. **Mr. Hornby** suggested that the matter might be settled by the National Physical Laboratory, and Counsel for the applicants having agreed to his suggestion, **The Chairman** said that Committee would consult the N.P.L. if it was thought necessary.

Mr. Frederick Thompson (Messrs. Thompson & Co.) was the final witness for the opponents. He said that his firm, which represented a number of Continental manufacturers, and particularly the Swiss makers of "Rex" meters, was taking up the manufacture of Rex meters in this country, the actual manufacturing process being carried out by the Power Equipment Co., Ltd. The marking of imported parts would seriously handicap the carrying out of that policy, because it would create the impression that his firm was a foreign firm or merely a representative agency of foreign firms. Mr. Thompson's further evidence was corroborative of that given by the earlier witnesses for the opponents. After counsel for both sides had summed up the evidence, the inquiry was concluded. The Committee will submit its recommendations to the Board of Trade in due course.

Round-tank Switchgear.

Some notes on the "proving" tests imposed by Messrs. Ferguson, Pailin, Ltd., on their "R"-type high-voltage, oil-immersed, circuit breakers.

THE operating safety of power supply networks depends on the switchgear's capability of interrupting its rated short-circuit kVA. The short-circuit duty imposed upon oil-immersed circuit breakers has been increased enormously by the advent of super-power systems and will be further increased when these networks are interconnected by the national transmission grid.

Circuit breakers are called upon to smother momentary short-circuit outputs as great as 2,000,000 h.p., and the problem in this country will very shortly be how to substitute higher rupturing capacity breakers for those already installed.

Supply authorities cannot afford to jeopardise their services and endanger their equipment by relying on breakers which have only a theoretical, or calculated, short-circuit interrupting ability.

Messrs. Ferguson, Pailin, Ltd., having recognised these facts, base their latest designs on short-circuit test results. Advance models are tested and the resulting commercial designs undergo a series of "proving" tests before going forward for production. An example of a series of proving tests with oscillograms was referred to in our issue of May 23rd, 1930, pp. 973-4, which article described the "R"-type oil-immersed circuit breaker as incorporating the three phases in one round (cylindrical) boiler plate tank, having a dished bottom and being attached to a domed top plate by short stout bolts; the operating mechanism is internal and a pebble-filled venting and baffling chamber is provided. To indicate the increased security claimed to be afforded by the round-tank type, as compared with those having flat top plates and flat-sided tanks, three cases of breakers that failed on short-circuit power well over their ratings are illustrated herewith.

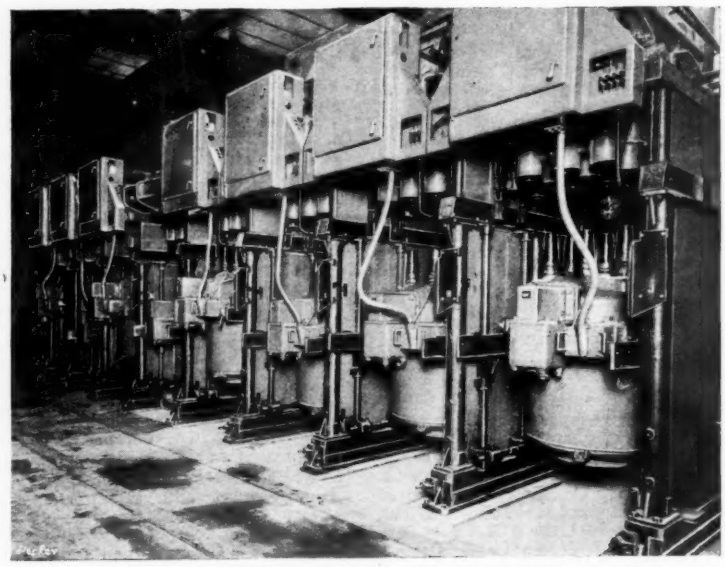
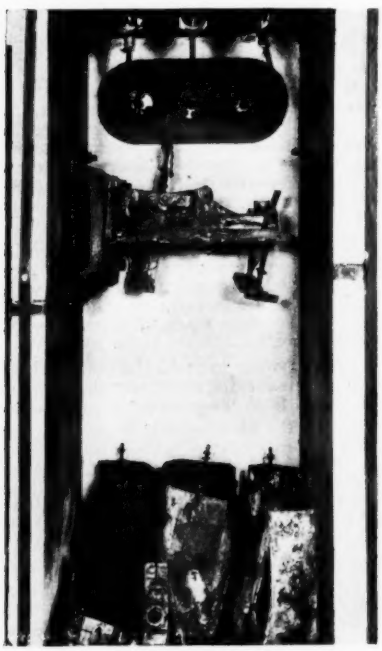


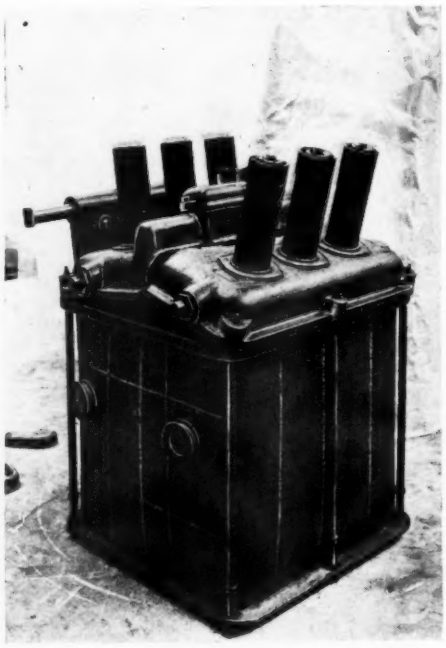
Fig. 1.—Bank of Round-tank Circuit Breakers.

Fig. 2 shows one of a number of breakers which were installed some 20 years ago and remained in service in spite of a considerable increase in plant capacity. Recently a short circuit occurred immediately outside the generating station and the switch failed; an explosion occurred, the oil tanks were blown off, the doors of the cell were blown across the engine room, and the plant was in consequence shut down for some time, but the ensuing fire was extinguished before it did appreciable damage, otherwise the consequences might have been disastrous.

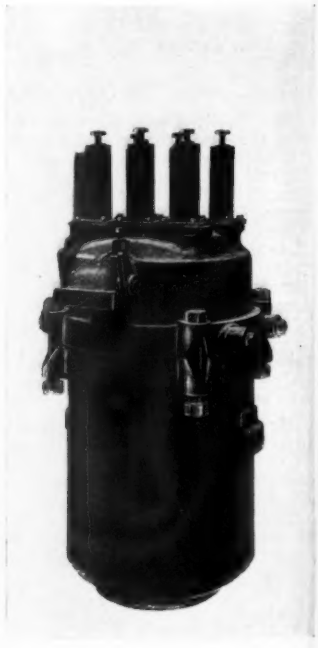
The breaker shown in fig. 3 was tested well beyond its rated breaking capacity in order to determine its factor of safety and the manner in which failure occurred is clearly demonstrated. The top plate was broken across its centre by the combined effect of gas pressure and the impact of oil, which was driven upwards from the arc. In this case the escaping oil was fired and, had the breaker failed whilst in service, serious consequences might have resulted.



Breaker failure in service when attempting to clear severe over-rated short-circuit power.



Severe over-rated short-circuit test result on breaker in flat-top plate and flat-sided tank.



Round-tank breaker after interrupting over-rated short-circuit power, damage confined to tank interior.

Figs. 2, 3, and 4.—High-voltage, Oil-immersed Circuit Breakers after Overload Operation.

Fig. 4 shows a round-tank breaker which was tested so far beyond its rating as to render its internal mechanism useless, but, although the breaker had reached its limit, it cleared the short circuit without failure of its outer casing; hence, there was no danger of external damage being done. The horizontal cross beam, which forms a guide for the lifting rods, was bent upwards at the centre about 5 in. The force required to deform the beam was 3,800 lb., which pressure was developed by the upward blast of oil.

The above examples show that correct choice of type cannot be over emphasised. American and German engineers have increased rupturing ability consequent upon system growth by installing exceptionally robust breakers incorporating the three phases in a common cylindrical tank, which form occupies the minimum of space, and Messrs. Ferguson, Pailin decided that this class should have an application in this country also. A complete range has accordingly been developed, comprising 16, 20, 24, 28, 32, and 36-inch diameter tank breakers and further developments are in progress for increasing the range, which has not only been designed according to theory, but has also withstood onerous conditions of test.

The sudden formation of an arc between parting contacts in oil creates gas-bubble effects similar to those produced by the detonation of a depth charge under water. An impulse pressure wave is transmitted in all directions, its intensity being inversely proportional to the square of the distance from the axis of the arc. The pressure is due to the inertia of the oil and its value depends on (i) the rapidity with which the oil can move away from the gas bubble, and (ii) the rate of gas formation. A further effect of the instantaneous formation of the gas bubble is to shoot the oil against the underside of the breaker top plate. Factor (i) means that an excessive head of oil above the point of break will increase the impulse pressure, on account of the extra weight of oil to be lifted. The force of the upward oil blast, *per se*, may become the limiting factor in the ultimate short-circuit strength of a breaker on account of the serious forces that may be developed. Phase barriers are liable to be broken unless they are flexible.

The continuous production of gas by the arc creates a static internal pressure, and it is of no avail to provide a large venting orifice in the breaker top plate for relieving the pressure during the arcing period. The orifice would be blocked by the surging oil and venting would not take place until after the final extinction of the arc; a large amount of oil would be ejected under such conditions. Short-circuit tests have shown that a small orifice leading to an adequate pebble-filled venting chamber is the most efficient arrangement, in conjunction with a perfectly gas-tight joint between the tank and top plate and a sufficient volume of air cushion above the oil surface to absorb the arc gases without a dangerous rise of gas pressure. A good breaker must be designed as a boiler, with one end removable; therefore, a cylindrical steel tank with a dished bottom held to a domed top-plate by short stout bolts is the nearest commercial approximation to a spherical container, which would be ideal for balancing stresses with the minimum weight. Fig. 1 illustrates a bank of duplicate bus-bar metal-clad switchgear incorporating round-tank oil-immersed circuit breakers.

The characteristics of the power supply network affect the task of rupturing a definite amount of short-circuit kVA. When a breaker interrupts a 3-phase short circuit the current is first interrupted on one phase and then simultaneously interrupted on the remaining two phases, the time interval varying from one-half to one cycle. If the neutral point of the generator be connected to the point of short cricuit, then the normal recovery voltage which appears across the gap in the first phase to be interrupted will be 57.7 per cent. of the line voltage. If the short-circuit point be not connected to the generator neutral point, then that recovery voltage will increase to 86.7 per cent. of the line voltage. In order to impose the hardest conditions on an oil breaker during short-circuit tests it is usual to test it with the generator neutral point insulated and the short-circuit point earthed, the latter being necessary in order to keep the oscillograph shunts near to earth potential.

The two distinct periods in each half-cycle of a.c. arcing are those of (*a*) current flow, when energy is present in the arc, and (*b*) "zero pause," when current does not flow and the gap is bridged by hot arc gases. The recovery voltage available for restriking the arc at the "zero pause" is governed by the (1) power factor of the short circuit; (2) degree of asymmetry, *i.e.*, point of voltage wave at which the short circuit is initiated; and (3) rate of rise of recovery voltage consequent on the extinction of the arc.

A maximum value of recovery voltage is produced by a totally-inductive circuit, *i.e.*, a short circuit at zero power factor, but this condition does not quite arise in practice. The phase angle of a short circuit at the terminals of a generator is usually between 70 and 80 degrees. Lengthening the arc is equivalent to the insertion of resistance in the circuit, which reduces the phase angle, but at the most will not reduce it to less than 60 degrees. The recovery voltage for that phase angle is still 86.6 per cent. of the maximum value that would exist at zero power factor (phase angle 90 degrees).

The degree of asymmetry affects the time intervals between the zero values of current. If a perfect doubling effect existed, the first zero value would not occur until one complete cycle had elapsed. For a perfectly symmetrical short-circuit current wave, the zero values of current occur at intervals of one-half cycle and the recovery voltage is therefore affected by the degree of asymmetry, because the cycles of terminal voltage are symmetrical throughout the short circuit, although the r.m.s. value gradually decreases. A further point in this connection is that each re-striking of the arc is virtually a fresh short circuit; hence the degree of asymmetry is changed at each re-ignition, depending on the point of the voltage wave at which the arc is re-struck.

As regards the rate of rise of recovery voltage, it will be appreciated that each time the arc goes out the circuit has to readjust itself. The change in the electrical state of the circuit is accomplished through transient oscillations the frequency of which depends on the values of capacity and inductance of the circuit over which short-circuit power is being fed through the breaker. The highest frequency of oscillation occurs when a breaker is tested at the terminals of an isolated generator, because the values of inductance and capacity are then the minimum, *i.e.*, the rate of voltage rise at the moment of "zero pause" is a maximum and the greatest arc lengths will be experienced in the breaker. That condition of affairs occurs at factory short-circuit testing plant, and those tests are therefore more drastic than tests carried out on a power system where the higher values of inductance and capacity produce a lower frequency of oscillation. This point has been proved many times by direct tests on a given breaker, which have always produced shorter arc lengths when the breaker was tested on a power system than when it was tested at the factory with an isolated generator.

The Generation of Electricity.

A review of the analyses and summaries of the returns of fuel consumption and kWh generated made to the Electricity Commissioners by authorised undertakings and others for the year 1929-30.*

THE analyses and summaries of the returns made to the Electricity Commissioners of electricity produced and fuel consumed at generating stations in Great Britain during the year ended March 31st, 1930, follow the general form adopted in preceding years, subject to one important modification.

In lieu of the area groupings hitherto employed, the various stations have been rgrouped so far as is possible in accordance with the areas of the new regional ("grid") schemes. The stations in those portions of Scotland which are not at present included in any scheme have been grouped into areas designated "South of Scotland" and "North of Scotland," respectively. Selected stations are shown in thicker type.

Some of the more striking features of this annual report, commonly spoken of as the "fuel returns," were discussed last week in the ELECTRICAL REVIEW (p. 697). The rate of growth of output was slightly in excess of that for the previous year 9.95 (as against 9.6 per cent.), and increased the total kWh generated in the 568 stations making returns to 11,961,621,965. The total amount of fuel, however, increased by only 6.06 per cent. to a total of 10,141,291 tons. The number of stations was four in excess of that for the previous year, but the chief cause of the increase is due to the inclusion of 24 existing stations previously non-statutory. Actually 33 stations were closed down, but eleven new and two existing stand-by stations were brought into commission.

The proportion of kWh generated in steam stations amounted to 95.64 per cent., oil 0.63 per cent., producer gas 0.11 per cent., waste heat 2.06 per cent., refuse and town gas 0.18 per cent., and water 1.38 per cent.

Perhaps the chief interest in the returns for many engineers centres in the thermal efficiency tables, which introduce a competitive element between undertakings. As we mentioned last week, the North Tees station takes first place among the 318 steam stations, while the Kearsley station, judging by its remarkable performance during its six months' operation, promises to put up a record for this country on a full year's

* Generation of Electricity in Great Britain, year ending March 31st, 1930. H.M. Stationery Office. 1s. 6d. net.

run. The following table gives the leading particulars of power stations with a thermal efficiency of over 20 per cent. :—

Station.	Thermal Efficiency	lb. coal per kWh.	Load factor per cent.	kWh generated (millions).
North Tees (Newcastle-upon-Tyne E. S. Co.)	22.83	1.28	51.0	286
Barton (Manchester Corporation)	22,10	1.33	43.0	392
Barking (County of London E. S. Co.) ...	22.02	1.50	37.7	475
Ferrybridge (Y. E. P. Co.)	21.31	1.37	47.3	128
Spondon (Derby and Notts. E. P. Co.) ...	21.14	1.57	48.6	129
Padiham (L. E. P. Co.)	20.50	1.39	61.0	57
Lister Driver No. 3 (Liverpool Corporation)	20.30	1.48	53.0	245
Kearsley (L. E. P. Co.) (*a*)	24.36	1.18	55.1	64
Deptford West (London Power Co.) (*b*) ...	22.14	1.39	37.7	137

(*a*) Commenced supplying October 1st, 1929. (*b*) Commenced supplying June 17th, 1929.

It will be seen that all these above stations, with the exception of Padiham, had an output exceeding 100 million kWh per annum, while several very small steam stations had a thermal efficiency of less than 5 per cent. On the other hand, the good work done by the heavy-oil engine in small undertakings is indicated by the fact that out of 160 stations using this form of prime-mover no less than 65 have thermal efficiencies exceeding 20 per cent. Reference was made last week to the creditable performances at the stations at Buxton and St. Martin's Lane.

Load factors in excess of 50 per cent. appear common, 59 stations being so credited. In the majority of such cases, however, the load factor is based on the running hours, and as many of the undertakings are receiving partial bulk supplies, the term "plant load factor" would best describe the condition. The highest load factor is 90.2 per cent. for the Hebden Bridge Station, which also receives bulk supply from the Y. E. P. Co. Horden B. waste-heat station of the Newcastle-on-Tyne Electric Supply Co. has the highest load factor based upon 8,760 hours, *viz.*, 84.8 per cent; this station feeds into a large interconnected network able to absorb its full output at all times.

An article entitled "The Official Fuel Returns," dealing with the method of their presentation, was published in the Electrical Review of January 31st, 1930.

The Overhead Lines Association.

New Officers and Extracts from the Addresses of the Retiring and Incoming Presidents.

THE first meeting of the 1930-31 session was held in London on October 15th. Mr. Theodore Stevens, the retiring president, was in the chair, and announced the election of Mr. W. C. Bexon, chief engineer to the Ayrshire Electricity Board, as the new president, and that Mr. C. T. Allen, of the South Wales Electric Power Distribution Co., had been elected vice-president. Major T. Rich resigned the hon. secretaryship, which has been undertaken by Mr. G. W. Molle.

Mr. Theodore Stevens, the retiring president, in a short address, inquired how far the avowed objects of the Association had been materially advanced. The most important accomplishment of the third year's work had been the unanimous adoption of a resolution of co-operation with the various organisations concerned with amenities, which took place at the meeting on January 15th last. As the result of much correspondence and conferences with the Council for the Preservation of Rural England there had been mutual agreement that overhead-line construction was necessary for economy of selling price to consumers, on account of the relatively high cost of underground work. It was also an object of the Association to assist in making available with reasonable promptness in every home throughout Great Britain an abundant supply of electricity, and he asked whether the Association had done all that might have been done towards that object. He admitted, however, that there was something of a vicious circle to be broken. Great Britain at the present time could boast of less than 30 per cent. of its homes served with electricity; as an instance of what was happening, mention was made of a certain village which had enjoyed, and could continue to enjoy, a non-statutory supply, but was threatened with the prospect of deprivation of supply because a relatively powerful company had influence, required a monopoly of a larger area, and would give no guarantee to continue that small village supply. The point arising out of that instance was that unless any particular community was sufficiently astute to foresee, and take effective steps to avoid, the consequences of leaving itself to be exploited, it might find that it had drifted into legal acquiescence. At the same time he contended that it needed but very few years to develop and make an economically-designed rural distribution system pay a fair return on the capital invested in it, whilst selling energy at a price economical to rural consumers. If money were made available for distributing electricity (*a*) on terms no more onerous than those imposed on the constructors of the grid, and (*b*) with equal obligation to earn prompt profit on the investment, villages and rural populations could all have supplies; but, whilst the Development (Local Guarantees and Grants) Act, 1929, was useful to local authorities, companies could not be advised to accept the conditions imposed. To increase consumption was the only practical way of reducing the price per kWh to consumers, and the sooner consumers fully realised that they could break what he had called the vicious circle and co-operate with the suppliers of electricity, the quicker would high prices come down.

There were instances of the price per kWh to a large number of domestic consumers having been definitely reduced by 50 per cent. within 12 years and consumption increased 3½ times, but they did not want to wait twelve years. Reference was made to the paper by Mr. Lennox Stanton before the Association on March, 20th, 1929, and from the paper by Dr. F. A. Gaby, chief engineer of the Hydro-Electric Commission of Ontario, before the second World Power Conference in Berlin in June of this year, figures were quoted in support of the general contention that, once facilities were provided for cheap supplies, the demand went up rapidly, with a consequent reduction of costs and charges. Some figures were also quoted from the paper Mr. R. E. Jones, assistant engineer to the Hydro-Electric Commission of Ontario, read at the June Convention of the American Institute of Electrical Engineers, dealing with the cost per mile of rural lines in Ontario and the distances at which one certain load could be supplied with the same regulation at different voltages.

Mr. W. C. Bexon then took the chair and delivered his presidential address, commenting with satisfaction upon the fact that the membership of the Association was now 205. The wayleaves position was even now far from satisfactory; different authorities had different rentals, and consents were more difficult than ever to obtain. He hoped a standard wayleave agreement could be arrived at in co-operation with the National Farmers' Union, because with that body behind them the supply authorities would be in a much stronger position. The railway companies took a long time to give consent to wayleaves, and the expense was extortionate; in his own case, for every wayleave consent, he had to pay the railway company £3 3s. for its standard printed agreement, and usually a rental of 10s. per annum for each railway crossing. If all landowners demanded the same terms it would prohibit distribution altogether. Railway companies could not expect cheap electricity whilst they took up that attitude. Fortunately, through the efforts of the Association, the Post Office was granting better facilities.

The Association should take in hand the standardisation, so far as was possible, of overhead-line construction. Alarming figures were heard of as the costs of various classes of overhead lines; for instance, a 3-wire line using No. 6 copper and working at 11,000 volts was erected at a cost of £300 per mile. In the report on the proceedings of the Electricity Commissioners' Conference on Electricity Supply in Rural Areas, dated July, 1928, some useful information about cost was given, and it appeared that the average cost per mile of an 11,000-volt single-circuit line of 0.05 sq. in. conductors was £690, exclusive of wayleaves, easements, tree felling, compensation, &c. A recently-erected overhead single-circuit, three-phase line suitable for 11,000 volts cost £629 14s. per mile, the size of the copper being 1/0; that figure did not include supervision, but it did include bird guards, costing £25 4s. It was very disheartening to find so many variations in costs, considering that all lines were supposed to be erected in accordance with the Commissioners' Regulations, and it was to be hoped that the Association would endeavour to arrive at some standard form of construction in the form of an Overhead Lines Association Specification. There must be a considerable reduction of the capital cost of overhead lines if rural electrification was to be made a paying proposition, and the Electricity Commissioners would be only too pleased to amend their Regulations if the Association could put forward facts and figures to warrant amelioration. Now that the "all-mains" wireless sets had come on to the market in such numbers people in rural areas would do everything

possible to get electricity into their houses; but, owing to the fact that those people could not afford to use electricity to any great extent, it was necessary to reduce the capital cost.

Since the Association had been in existence manufacturers have appeared to take more interest in the subject, and they were doing everything possible to reduce the cost of open-air switchgear and transformers; he hoped it would be possible for the Association to standardise the latter, more particularly the pole type, and so help to reduce their cost. At present their overall dimensions for the same capacity varied with all the manufacturers, and fixing arrangements differed, all tending to increase the cost to the purchaser.

Rating, too, was a matter worth consideration, although perhaps a little outside the objects of the Association. Private power stations, under the De-rating Act, were practically free from rates, whereas public supply stations were severely handicapped in that respect. Further, go-ahead undertakings were spending large capital sums on erecting transmission lines in the country, and must have sufficient revenue to pay working costs and capital charges, which meant a fairly large gross profit. Those undertakings, under the present basis of assessment, were taxed very heavily, and that was causing delay in extending into the rural areas. Why should not an electricity undertaking be assessed on the same basis as ordinary manufacturers? To alter that condition of affairs would require new legislation, but he wished to see the Association sufficiently strong for any recommendations sent to the Electricity Commissioners to be considered favourably.

The President mentioned that members would be invited to inspect the overhead construction and supply arrangements in Ayrshire during the summer meeting next year.

Research in Industry.

The influence of voltage variation on the electrical production of heat and light. Do we ask ourselves how much better we might be if the spirit of anti-empiricism had a firmer grip?

By CLIFFORD C. PATERSON, O.B.E., M.I.E.E.

(*Extracts from* PRESIDENTIAL ADDRESS *delivered before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE distinction between so-called "pure" and "applied" research is only one of ultimate object. The working ideal which inspires the research man is the substitution of knowledge for empiricism, which finds as true an expression in industry as in those research institutions whose labours are furthest removed from practical utility.

An important change of outlook in respect of research has taken place within the industry during the past 20 years, and is still in progress. There has never, I think, been a lack in industry of those who realise how discovery results from research, and who are ready, with all the enterprise at their command, to take up any new discovery and exploit it for the benefit of industry. Such discoveries were, however, regarded as isolated events intruding themselves into the existing art as they knew it. To-day we are realising that the great march of industrial progress depends essentially on research.

The electrical industry has a record in research in comparison with other industries of which it need not be at all ashamed; but that is hardly the point. Are we satisfied that the industry is sufficiently dominated by the consciousness that great progress is possible—but only as the result of scientifically inspired inquiry? Do we ask ourselves how much better we might be if the spirit of anti-empiricism had a firmer grip? A firmer grip of whom? Our research workers? They are not usually content until they find out the reasons for things. Our electricity committees and public authorities who control supply undertakings? I don't know that I dare speculate upon the reception which proposals to spend substantial sums on research would, or do, receive from them. I can imagine that some guardians of the ratepayers' money would hold the view that it was not their business to expend it on such objects. Fortunately this has not been the view of the Electricity Commissioners. What about the attitude of commercial managements? There are some who would blame them; but I find that commercial men usually have an instinctive leaning towards research, if only as a safeguard for the present and an insurance for the future; but commercial men must usually accept the advice of their trusted engineers. What kind of advice do engineers usually give? The capable people whom we meet every day. Not the few to whom we can point as striking examples of men with faith and vision, but the qualified and reliable engineer of sound experience who has earned an honourable reputation for surmounting difficulties and "getting there" somehow. The man of self-reliance and good judgment in factors of safety, who is usually sound and is relied on by commercial managements. He is the man who keeps the industry going. When he has the right outlook and realises that research has weapons and methods different from the arts of the engineer, he is the most powerful influence for progress in industry.

Now, is there not a danger that the training of engineers and their customary outlook may be inimical to the utilisation of research by industry? The engineer has spent his life saving people expense by his judgment and intuition. Is it not true to say that empiricisms with him are only bad when they are unsuccessful? If an empiricism works, why not leave it alone, when to eliminate it means costly work and a special staff? For him to urge the need for research in his particular domain, is it not belittling his own prescience? Is it not his business to see that there is no unnecessary expense?

The engineer has a difficult and contradictory task, for he must be at the same time an empiricist when he inspires his production or operative staff, and the reverse in his outlook on the future of his part of the industry. Psychologically this may prove to be the essence of our problem. Empiricism has an essential place in almost every industrial process, because schedules and specifications can only be based on theory and principles so far as these are known, and the rest must be rule of thumb. Furthermore, the schedules must be such that people who operate them can follow them blindly and empirically. So the atmosphere of production and operation is necessarily empirical, and those who design its framework must assume no outlook but the empirical by those who are to work within it. What incitement, therefore, is there for the directing engineer to turn his thoughts to the importance of finding out the reasons for things and their underlying theories? Seeing that he must carry the constant anxieties and urgencies of the practical difficulties of the moment, is it surprising that a habit of mind grows in which research and all that it stands for is forgotten, or merely dropped back upon as the last refuge of the destitute, and when it is already too late to be of use? I have often noticed in this and other countries the difficulty which many practical administrative engineers have in recognising research problems when connected with their own daily work, or, if they do recognise them, seriously to entertain the possibility of organising to cope with them. The first object of research to them is the discovery of some new product. They are not keen to instigate work which shall explain some of the principles underlying their operations, so that these can be carried on more intelligently, yet these problems occur in every part of the industry: on the supply as well as the manufacturing sides and in selling as well as in designing; for example:—

Recognition of Research Problems.—The industry has been, and is still, very troubled regarding the permissible fluctuations of voltage at consumers' terminals. The recognised limit is ±4 per cent. There have been strong advocates for an extension of the limits to ±6 per cent., but it is recognised that the 4 per cent. limit is constantly exceeded—that is to say, many consumers find their voltage considerably above or below these limits, and others who do not know anything about voltage find that their electrical apparatus fails to function properly.

Now, if manufactured articles do not come within the expected or desired limits, we do not forthwith widen the limits; an effort is made, first, to see how the individual specimens of a product actually do vary about its mean value, and, secondly, how the variation affects the practical usefulness of the product. As manufactured, each individual article amongst the mass differs by a certain percentage from the objective aimed at in respect of any given factor. There is a certain spread or distribution about the objective which can be represented diagrammatically, and the shape of which will give valuable information; but its main object is to show what proportion of the product lies within certain tolerances.

For instance, three different types of lamp had, over a certain period of production, the three distribution curves of efficiency shown in fig. 1, at the voltage marked on the lamps. Each is built up of a very large number of individual readings, each one of which is plotted vertically above the appropriate percentage which it is above or below the objective

mean. The curves are cross-sections of the product and a measure of its uniformity. From them can be deduced at once the tendency of the life and the illuminating power to vary in consumers' hands. Curve (*a*) is for a well-established product, (*b*) for a less mature product, and (*c*) illustrates the effect of an adjustment during the period of production under consideration.

When the proposal arose to extend the voltage limits of electricity supply one naturally looked for similar curves showing graphically the frequency of occurrence of voltage deviations over supply areas, for different times during the 24 hours and at different times of the year. I could not find that any effort had been made by the manufacturers and sellers of electrical energy to do any such research on this, the only feature of their product which can vary. If the manufacturers of appliances which are intended to be used on these networks, and who have exactly parallel problems, were to do so little research on them as not even to have an effective picture of the "spread" of the product, perhaps the comments of the suppliers of electrical energy can be imagined best by those who know them most intimately. Statistical surveys are nearly always expensive, if they are to be properly made; furthermore, the machinery for obtaining the data must be a continuous service for watching the gradual improvement, or deterioration, of the product from year to year. I venture to suggest, however, that the difficulties are small compared with similar problems in the production of many individual appliances which are to be used on such supplies. In Europe alone upwards of £60,000 is spent annually on the statistical study of lamps only. It is not philanthropy; it has proved itself to be the basis of intelligent production.

electricity or the "generation" of the articles to be used with it, should recognise where the weapon of research and inquiry can be used in the interests of the public, and jointly base further developments and technical policy upon the results. Without any desire to prejudice controversial issues, may not one suggest that it would be more scientific, or anyway more dignified, to consider any proposals for extending the present 4 per cent. limits in the light of such a study as I have indicated, rather than in the darkness of empiricism and guesswork? Is it even too much to suggest that the method of specifying legal limits of voltage variation, bequeathed to us from the last century and which is combined with the right of individual citizens to complain, may not be the best suited to the facts of the case? Might there not, for instance, be laid down, instead of a single voltage limit, a maximum distribution curve with recognised independent machinery in every district for its determination?

Is not this an example of a research problem which does not appear to have been recognised or tackled as such?

Research Resources.—Regarding the actual machinery we have for experimental research, it appears to me that we are organising on sound lines. We have, broadly, a combination of strong individually-owned research establishments serving the Government and manufacturing concerns, to whom they belong; and public or semi-public establishments like the National Physical Laboratory and the Electrical Research Association, which co-operate with industry in the most genuine and effective way.

Whilst one feels that our research equipment, as an industry, is well founded and efficient, this does not mean that it is adequate, or that its efforts are invariably well-directed. But

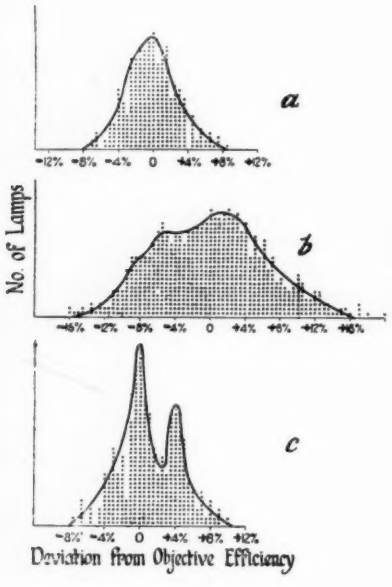


Fig. 1.

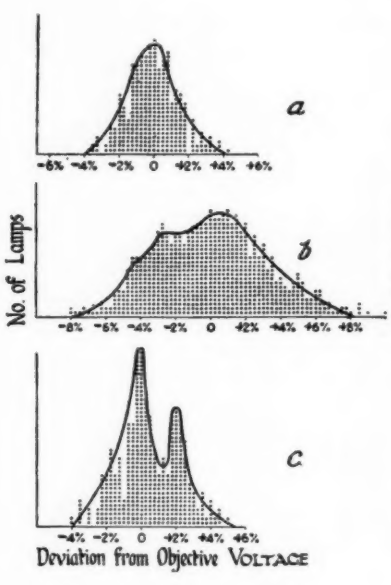


Fig. 2.

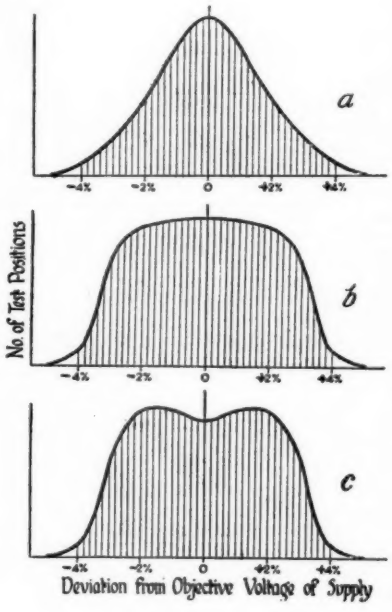


Fig. 3.

Uniformity of Voltage.—Most electrical devices which use electricity for raising temperature, such as lamps, hot-plates, and radiators, have both their life and their effectiveness in operation very dependent upon the voltage of the supply. It is fruitless to work for a high degree of uniformity and efficiency of the appliances manufactured when the circuits in which they are used are so variable that they, in effect, reintroduce into the product as used by the public all the disadvantages which the manufacturer has been at pains and expense to eliminate. Let us re-evaluate the curves (fig. 1) on the basis of the percentage of nominal voltage, plus and minus, which would be needed to bring the lamp product to precise uniformity. This is shown in the curves in fig. 2. Much effort is at present being expended further to reduce this spread, but the curves as they are show that in (*a*), which is the best, 86 per cent. of the product lies within two per cent. of the mean value in volts. In (*b*) and (*c*), of an abnormal product, some 80 per cent. of the lamps falls within four per cent. and 2½ per cent., respectively. The fig. 3 curves might represent the frequency of occurrence of voltage variations for an electricity supply which is maintained within the existing legal limits of ±4 per cent. The question arises: which, if any, curve represents the true distribution?

I think we shall find that in many cases the uniformity of voltage has been considerably outstripped by that of the appliances to be used with it. What the public experiences in using electricity is the resultant of these two frequency-of-occurrence curves; and their study together will enable an estimate to be given of the proportions of users in any district which may expect good, indifferent, or bad service from appliances. So my plea is that engineers, whether engaged in the generation of

does not an industry usually get what it deserves? It is in the end the embodiment of the psychological outlook of those who, through money or through position, have during the previous 20 years used their influence well or ill, and our successors will rightly judge us by the vision of this generation when laying for them the foundations of knowledge and practice upon which they perforce must build. Those who have made sacrifices in order to bring about voltage standardisation have faced the inconveniences largely with this reflection in mind.

The main problem is with the small concern whose resources do not allow it to maintain its own research staff and laboratory on a scale large enough to make them worth while. No outside body can give that service which is afforded by a research staff within the organisation. For the supply section of the industry a central co-operative organisation, if well supported, may suffice for most requirements, but what can the small manufacturing concern do?

Cost of Research.—The cost of experimental research is high, and even that of research of a more statistical character is not to be minimised. In a self-contained experimental laboratory it is well to assume that each research worker entails at least two other workers who are not experimentalists. The ratio of investigatory technically-qualified *personnel* to mechanics, administrative, and maintenance *personnel* is as one-third to two-thirds. I know of laboratories which run nearer to a one to one ratio; in some cases the nature of the work justifies this, but I am confident that as a general rule the most efficient ratio is between 2 and 2.5 to 1. For the overall cost of running a laboratory, one is not far out if one multiplies by three the total salaries of the research and experi-

mental people; a self-contained laboratory with a total *personnel* of 50 would have 17 experimentalists and cost £15,000 per annum, whilst one of 150 would have 50 experimentalists and cost £45,000 per annum. I am not speaking of laboratories which have the responsibility of running the technical processes of a factory, but of those whose contact with such processes is purely investigatory.

Electric Heating.—For many purposes, apart from cost, existing materials leave little to be desired, but for other purposes the limitation of the temperature at which they can be run is serious. All purposes for which a high temperature is required could be made much more effective if a higher-temperature alloy wire could be found. At present the problem is a metallurgical one. The maximum temperatures at which satisfactory service can be obtained from existing alloys is determined by their resistance to oxidation. Stainless steel does not remain untarnished because it is not oxidised, but because it is covered with a very thin, transparent, film of a highly protective oxide. It offers little protection, however, when the metal is heated. The protection in the case of nickel-chromium "resistance" alloys is more effective, but oxygen penetrates more rapidly as the temperature is raised. Moreover, the oxide coating tends to crack and flake off each time the wire is heated and cooled, until, finally, the cross-section of the wire is seriously reduced; deterioration then proceeds at an increasing rate until failure occurs. The suitability of an alloy is thus determined by the protective and adherent properties of the oxide, rather than by the properties of the alloy itself.

The maximum temperature at which any particular alloy is satisfactory also depends upon the diameter of the wire used. The thickness of the protective layer formed, and the rate at which further penetration proceeds, are independent of the diameter of the wire. In any given period of time a thin wire, therefore, deteriorates more than a thicker one. In large sections such alloys are already being used at temperatures within 200 deg. C. of their melting points. With further improvements in the protecting power of the oxide, the melting point itself may become the limiting factor. Other materials besides metals might be used as resistance elements, and very small changes in the composition of the alloy have already been found to exert a profound influence on the properties of the oxide layer, resulting in an increase of 100 to 200 per cent. in the life of an alloy when used at 1,000 deg. C.

*Electric Lighting.**—In the realm of incandescent filament lamps marked advance seems, in the light of present knowledge, highly improbable. In fact, the luminous efficiency of the modern tungsten-filament lamp, which reaches 18 lumens per watt in the larger sizes, is not likely to be greatly exceeded so long as we confine ourselves to incandescent filament sources. Theoretically, by transforming power directly into light of maximum visibility (that is, into light of wavelength 5,550A) about 670 lumens per watt could be obtained, but the light obtained would be monochromatic and of a yellowish-green hue quite unsuitable for general illumination, for in it the colours of objects would cease to be observed. The introduction into the source of other wavelengths in order to correct this would result in a reduction of the efficiency. An ideal source which transformed power into light in this manner with no invisible ultra-violet or infra-red radiation, such as is emitted by all known incandescent solids, would produce something of the order of 200 lumens per watt. This, then, may be considered to be the theoretical maximum, if perfect colour rendering is to be obtained.

Tungsten melts at 3,600 deg. K. and at this temperature would give about 50 lumens per watt. In practice heat losses reduce the efficiency and, owing to the high rate of evaporation near the melting point, the running temperature must be much lower. As the result the output obtainable from ordinary gas-filled lamps varies between 10 and 18 lumens per watt, depending on the size and life of the filament. This is actually higher than with any other element and the only alternative would be high-melting-point compounds, such as carbides; they have been tried, but with, as yet, not very promising results.

Recently there has been a very healthy move away from objectionable brilliancy by the introduction of a properly diffusing glass bulb for all household lamps, and a tendency in modern fittings design to use diffusing glassware of large surface area and low brilliancy. We shall be considering during the next few years what uses there are for gaseous sources of light, which are comparable in efficiency with the larger filament lamps, but not so concentrated, for several of their limitations have recently been removed. To-day the hot-cathode discharge tube operates at commercial voltages and is capable of an output of from 12 to about 50 lumens per watt, depending on the size of the tube and the gas filling. Distinctly greater efficiencies are thus possible than with incandescent solid radiators. We have, however, still to get full control of the colour.

The essential difference between the radiation from solids and that from gases is that the former is continuous and the latter discontinuous, *i.e.*, it consists of certain wavelengths only. Thus the spectrum of mercury vapour (which is monatomic) consists principally of two yellow, one green, and one blue lines, while that of nitrogen (the molecules of which are not reduced to the atomic state by the discharge) consists of bands in the red, yellow, green, and blue. An extreme example is carbon monoxide, which gives such a large number of complicated bands that under low dispersion the spectrum might, at first sight, be thought to be continuous. The intensity distribution is also such that the light gives good colour rendering and is used for certain colour-matching lamps. Actually, a carbon-dioxide filling is used, but it is broken down to the monoxide by the discharge.

The light from a carbon-dioxide tube approximates to day light, but, unfortunately, it only produces from 3 to 5 lumens per watt; moreover, for interior lighting daylight is considered to be too cold, a warmer colour being much more desirable.

Changing the current through a gaseous discharge tube does not, in general, produce an appreciable change in the colour; for, although the colour of the light from a filament lamp varies from red to white as the current through it is increased (that is, as the temperature is raised) the colour of the light from a discharge tube depends only on the gases present. We can combine two or more high-efficiency tubes to give the required effect, or possibly (but this is much more difficult) combine different gases or vapours in one tube. Thus sodium and neon tubes combined give a pleasing warm colour, akin to candle light, the colour rendering being similar. The addition of a mercury tube allows anything between this and daylight to be obtained with fair efficiency. The approximate luminous outputs claimed for the hot-cathode type of tubes is given in Table I. With these three tubes, which promise to be satisfactory in other respects, such as length of life, many possibilities are opened up.

Table I.—Luminous Output.

Type.	*Lumens per watt.*	*Colour of light.*
Neon	12 to 35 ...	Red
Neon-mercury ...	12 to 35 ...	Blue
Sodium	up to 50 ...	Yellow

Many interesting developments of the original cold-cathode tubes are also taking place. In spite of the disadvantage that they require high voltages, they are particularly suitable for advertisement signs, marking land positions for aircraft, and various architectural decorative effects. The colours most easily obtained are orange-red by the use of neon, blue by the introduction of mercury vapour into tubes already containing argon or neon, green by using a yellowish glass with the latter mixture, and yellow by employing helium in a yellow glass. These gases belong to the "rare gas" group, and are chemically inert. When common gases, such as hydrogen, nitrogen, or carbon dioxide, are used, they rapidly disappear, or "clean up," under the action of the discharge, due to a variety of causes, such as chemical action, or to occlusion of the gas in the film of metal which forms on the glass in the vicinity of the electrodes; thus the original tubes had to be fitted with replenishing devices. Simpler methods of replenishment are at present in progress of development to permit various colour effects to be produced.*

Another and most remarkable effect is that, under certain conditions which we are only just beginning to understand, the discharge, instead of filling the whole tube as is normally the case, is concentrated into a narrow cord which may occupy only one-fifth of the diameter of the tube. This cord, the intrinsic brilliancy of which is much greater than that of the normal glow, does not remain stationary, but continually wanders in the tube with a peculiar sinuous motion, due to attraction and repulsion by charges on the inner surface of the glass. This gives an appearance of animation to the discharge, but it remains to be seen whether the effect will have many practical applications.

Conclusion.—Whichever way we look in the sphere of electrical engineering, dramatic discoveries, or achievements, rapidly succeed one another, and we seek as engineer to assimilate and turn them to practical use. But do we not treat our old problems, often but half understood, as if they were already solved? The more difficult problems are often those which the last generation threw aside in its hurry to grasp and exploit the next new thing. In our very right anxiety to do justice to the new, let us not neglect research on what appear to be the common and well-established things of the industry.

* This portion of the address was illustrated with experimental demonstrations of various gaseous lamps.

Royal Society of Arts.

The 1930-31 session of the Royal Society of Arts commences on November 5th, when Sir Edward Gait, chairman of the Council, will deliver his inaugural address. Papers to be read during the session include the following:—November 26th, "The Chemical Constitution of Coal," by Prof. W. A. Bone; February 4th, "The Effect of Standardisation on Engineering Progress," by Mr. C. Le Maistre; February 24th, "The Hard Fibre Industry (with special reference to the British Empire)," by Mr. A. Wigglesworth; February 25th, "Developments in Television," by Mr. W. G. W. Mitchell; March 18th, "Some Aspects of Inter-Imperial Trade," by Lt.-Col. Sir William Furse; and "Stainless Metals," by Sir Harold Carpenter. In addition, Prof. C. R. Darling is to deliver a series of three lectures on November 24th and December 1st and 8th, his subject being "Modern Domestic Scientific Appliances," while Capt. A. G. D. West is to give three lectures on March 9th, 16th and 23rd on "Sound Recording and Reproducing Machines and their Development."

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

A Plug-in Portable Lighting Fitting.

To meet the needs of machine shops and factories of a transportable lighting unit not encumbered by loose flexible cords, the "Typerlite" Co., 86, Cannon Street, E.C.4, has designed a novel form of lighting unit, fig. 1. This fitting is made up in two parts; the upper section consists of the usual "Typerlite" square stem, with a reinforced flexible top fitted with an Admiralty-type knuckle joint and a good-quality push-bar holder. The bottom of the stem is made up in the form

Fig. 1.—"Typerlite" Plug-in Fitting.

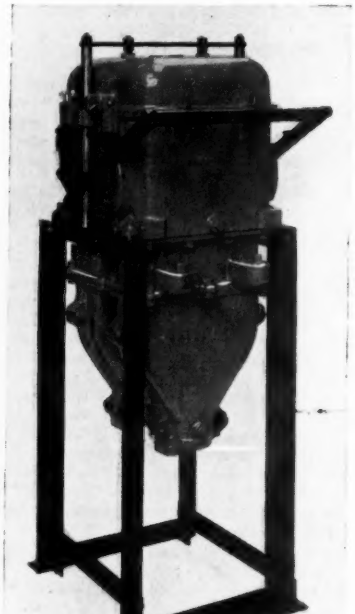


Fig. 2.—"J. & P. M.C.11" Oil-immersed Switch-fuse.

of a heavy cylindrical shield into which is fitted a standard B.E.S.A. "Reyrolle" plug top. This cylinder is guided by a special slot into another cylindrical chamber forming the base of the fitting, the battery containing a cast-iron 2-way box to which is screwed a "Reyrolle" plug base. Two screwed outlets each side of the base allow for the conduit to be directly connected to the iron box inside, so that the whole fitting is electrically and mechanically connected. The top of the base is made in the form of a flat rectangle and is fitted with a spring tray metal cover, so that when the upper portion of the fitting is withdrawn the top of the base can be closed flush with the floor, bench, desk, &c. The rectangular top is arranged to screw down flush to the surface on which the fitting is to be used. The whole of the fitting is solidly constructed from heavy brass castings, and it can be supplied in any standard finish. The stem of the upper portion can be supplied in any desired length. A number of these fittings have already been supplied to various firms for special purposes.

An Oil-immersed Switch-fuse.

Messrs. Johnson & Phillips, Ltd., Charlton, S.E.7, have introduced a new type of oil-immersed switch-fuse known as type M.C.11, fig. 2. It is designed for use on 11,000-V, 50-A, and 6,600-V, 100-A, 3-phase systems, and provides, it is claimed, an inexpensive and convenient means of tapping high-pressure lines for supplies to small consumers. It affords complete protection to the system and the operator by rupturing an overload or short-circuit in a time interval inversely proportional to the magnitude of the fault current. This design combines the advantage of a fuse in that the amount of metal to be volatilised is small, together with the advantage of an oil circuit breaker in that the arc takes place in a strong oil-tank under an ample head of oil. The fuse wire itself is specially selected for its tensile strength and its power to withstand the effects of ageing. The range of working current for which the above fuse wire can be supplied is from 5 to 100 A. The unit is robust, safe and practical, and is very simple in operation. The design is such that it lends itself readily to mounting on floor pedestals, wall brackets, in kiosks, &c., or in weatherproof form for outdoor poles. It can also be built in banks forming a complete switchboard, fitted with the usual busbar chambers, cable boxes, or cable tails. The unit consists of three main parts, *viz.*, a cast-iron tank, in the base of which are fitted porcelains supporting the fixed contacts; in the top an automatic shutter is arranged for shielding the fixed contacts when the top cover is raised for renewing the fusible elements; a cast-iron top cover, in which is fitted a vertically-moving frame carrying porcelain mounted contacts and fuse carriers; and the operating mechanism, consisting of a simple hand-lever and links for raising or lowering the moving frame, thus "opening" or "closing" the circuit, and also for raising the entire top cover and frame clear of the tank top for renewal of fuses. When it is necessary to renew fuses, the operator merely depresses the hand-lever, thus disengaging the contacts; he then releases the cover-retaining bolts, and a further depression of the hand-lever raises the entire cover and fuse carriers clear of the tank top. It should be noted that the top cover is positively locked to the tank during engaging or disengaging of contacts. Draincocks may be fitted to the tank, and mechanism may be padlocked to prevent unauthorised interference.

Truck Switchgear with Round-tank Breakers.

Messrs. Ferguson, Pailin, Ltd., Higher Openshaw, Manchester, have now extended the application of their new round-tank oil circuit breakers to include truck-type cubicle switchgear, fig. 3. The round-tank breaker (Elec. Rev., May 23rd, 1930, and this issue), has been subjected to many short-circuit tests, and the design is based and built up on the data obtained from these tests. For this reason the new type

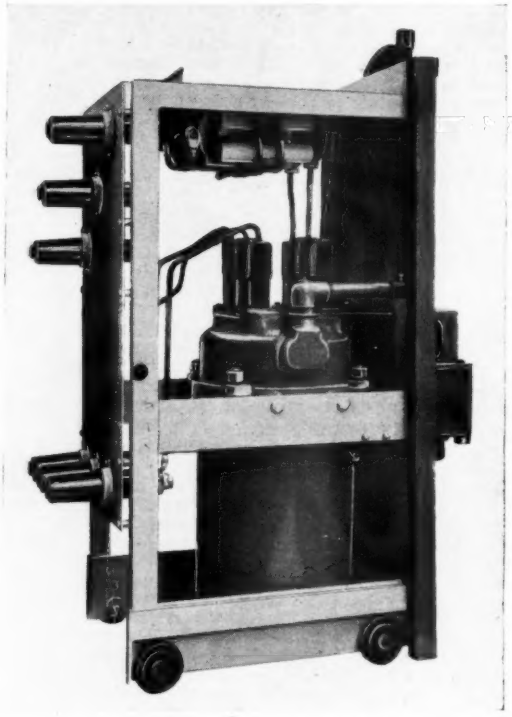


Fig. 3.—F., P. Truck Cubicle with Round-tank Circuit Breaker.

R.T. trucks have known and proved rupturing-capacity ratings. The truck cubicle housing is of "fabricated" steel construction and has dimensions practically identical with those of the truck gear incorporating the square-tank oil circuit breaker. The company is, therefore, able to supply new truck elements to replace equipment already installed. This adaptation of the type R.T. truck makes it definitely

possible to increase the known rupturing capacity of truck cubicle gear, without increasing the space occupied by the lower-rupturing-capacity switchgear. This is of particular interest in the many cases where it is desired to increase the known rupturing capacity, due to grid connection, plant extensions and the interlinking of power supply systems. The new truck will be seen to be an economical proposition, and it has the added advantage of reducing to a minimum the period required to change over to the new round-tank breaker with its higher rupturing capacity. A number of installations have already been completed in which "R" breakers have replaced switches of much lower rupturing capacity. It is interesting to note that circuit breakers up to and including 250,000 kVA

Fig. 4.—"Snail" Conductor Clamp.

rupturing capacity can be accommodated in the new Ferguson, Pailin truck. The new type R.T. truck embodies all the advantages of truck cubicle gear: ease of isolation and access; a fool-proof system of automatic interlocks and screens; and interchangeability of essential components, enabling a continuity of supply to be maintained. Breaker vent pipes are led exterior to the truck, and each assembled equipment is tested in accordance with the B.E.S.A. pressure test.

A New Conductor Clamp.

Embodying a patent owned by Electrical Improvements, Ltd., the "Snail" type clamp, fig. 4, for terminating overhead-line conductors has been introduced by Electric Transmission, Ltd., Culford Works, Kingsbury Road, Dalston, N.1. The cable is passed round what is virtually a pulley groove of involute form, the "tail" passing out at the centre point. By this means, not only is the travelling wave gradually absorbed in the cable within the clamp, but the cable is progressively relieved of its tension in the "V" groove of the clamp as it approaches the centre of the involute, where it is finally clamped. No cutting or dead-ending of the cable is necessary. A series of actual field tests on this clamp, wherein an A.C.S.R. cable span was stressed to 8,000 lb. tension, and vibrations of the order of 1,000 per minute and 2 in. amplitude were superimposed, failed to reveal, even after many days' duration, any signs of distress in the outer strands of the conductor. Other designs of clamp similarly tested caused ultimate fracture of some of the outer strands. Despite the absence of definitely bolted clamping pieces, except at the "tail," the "Snail" clamp develops a very high gripping strength, the ultimate tensile strength of the cable being reached without slipping or damage to the strands. The soundness of the design is borne out by its behaviour under test, and the clamp is therefore an effective contribution towards ensuring the security of the high-voltage transmission lines now being erected in various parts of the country. The clamp is marketed in a size suitable for cable diameters of $\frac{3}{4}$-in. to $\frac{7}{8}$-in. diameter overall, whilst a smaller size will shortly be available for diameters of $\frac{1}{2}$ in. and $\frac{5}{8}$ in.

Electric Poker Machines.

With the increasing popularity of poker work, it has been essential to cater for up-to-date needs by introducing reliable electric poker machines. We have just received from Messrs. Condrup, Ltd., 77 and 78, Fore Street, E.C.2, their list of this apparatus, giving details of the six patterns which they produce. When using such machines, the advantages of having both hands free for work, and the fine regulation, which gives a constant heat, are quickly appreciated. The "Pyrolectric" models can be used off either direct or alternating current, and they give good all-round service, both for designing and motto work. The other patterns, *i.e.*, "Electricon," fig. 5, and "Studio," are constructed for use with alternating current only. For these machines a very extensive range of points are supplied, which include many useful shapes for decorative purposes and for work where a repetition design is used. The motto worker is very well catered for with a variety of points specially suited to script writing, and the latest addition is a point for burning on glass. The "Electricon" No. 1 and the "Pyrolectric" are each fitted with an interchangeable terminal, so that the same machine can be used on any of the standard voltages. Pokerwork with such up-to-date machines will readily appeal to manufacturers, milliners, umbrella manufacturers, &c., and electric machines open a new field for traders.

A Twin Switch Combination.

A recent introduction of Messrs. J. H. Tucker & Co., Ltd., Kings Road, Tyseley, Birmingham, is the "Twin-Titan" switch combination, which consists of two "Tucker-Titan" all-insulated switches under one cover and mounted on a single oblong base. The combination is arranged for two 1-way switches, or one 1-way and one 2-way switches. The combination has been specially designed to save time in wiring and labour costs in erection. The movement fitted to the switches is quick-make-and-break, the same as in the "Tucker-Titan" models. The switch combination is available in surface, fig. 6, or semi-recessed patterns. The dimensions of the base are 3 in. by 1.9/16 in.

The combination is available in two forms, one consisting of two 1-way switches, and the other consisting of one 1-way and one 2-way switches. The device is obtainable in three finishes, all brown, brown and white, and all white. Suitable moulded "Telacite" blocks are supplied to match the colour of the base of the combination.

A Gramophone Pick-up.

The "Tangent" electric turntable and pick-up, fig. 7, has been evolved by Messrs. Gent & Co., Ltd., Faraday Works, Leicester, to enable the possessor of a wireless receiver to utilise his set in the simplest possible manner for the electrical reproduction of gramophone records. The electric motor is of high quality, and by a simple adjustment is suitable for all voltages between 100 and 250 a.c. or d.c., and in the case of a.c. 25 or 50 cycles. The whole of the electrical working parts of the motor are enclosed in an iron shell to eliminate sparking and stray magnetic fields. The turntable is fitted with an automatic stopping device. The pick-up is specially designed to give an even response with slight accentuation to the lower and higher frequencies, in order to compensate for the inherent discrepancies of the record. It is lightly suspended on a swivelling arm in which is incorporated a separate volume control. The portable case is strongly made and handsome in appearance, being covered with an attractive lizard cloth. The whole is no larger than an ordinary portable gramophone.

Fig. 5.—"Electricon" Poker Machine.

Fig. 6.—"Twin-Titan" Switch Combination.

Fig. 7.—"Tangent" Gramophone Pick-up.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Temperature Rise and the B.E.A.M.A.

Many of your readers will remember the discussion on "The B.E.A.M.A. and the Universities," and will doubtless be interested to hear that the result has been the opposite of what I had expected. I had argued that the teaching at our universities was far from being good enough for British engineers who had to compete with Americans, and that this state of things could soon be remedied by the B.E.A.M.A. having its own education department. The discussion, which began with my letter in your issue dated April 11th, 1930, led to my having some correspondence with the B.E.A.M.A. Council and with one of our Universities. But, quite contrary to my anticipations, it was the University that showed a willingness to accept corrections of the usual teaching, while the B.E.A.M.A. Council either objected to admitting that the usual teaching was wrong, or still supposed that it was right.

With regard to the matter of temperature rise due to heavy currents, the attitude of the B.E.A.M.A. Council seems hardly fair to British manufacturers; for, as I pointed out in my correspondence with the Council, these temperature rises are being misestimated to the extent of more than 300 deg. C., causing great mistakes to be made by designers. Such miscalculations have been made even by large electrical companies with research departments of their own. The misunderstanding has been due to a curious mathematical fallacy, but the following brief account of the matter will show that it admits of no dispute.

It is well known that the resistivity of copper at any temperature τ can be represented by $a+b\tau$, if suitable values are given to the constants a and b. From this it has been argued (on the Continent as well as in this country) that the resistivity may be assumed to remain constant at its average value $a+\frac{1}{2}(\tau'+\tau'')b$ while the temperature rises from τ' to τ''. This brings us to a point that is of great importance, but appears to have been generally overlooked. In a problem in which we have to integrate the resistivity with respect to the temperature, we certainly could make the above assumption, for the area under the graph of $a+b\tau$, from $\tau=\tau'$ to $\tau=\tau''$, is the same as the area under the graph of $a+\frac{1}{2}(\tau'+\tau'')b$. But in the problem with which we are here concerned the function that we have to integrate with respect to the temperature is the *reciprocal* of the resistivity. We cannot assume that the value of this reciprocal remains constant at $1/[a+\frac{1}{2}(\tau'+\tau'')b]$, for that would be making the mistake of using the *reciprocal of the average value* instead of the *average value of the reciprocal*.

The fact that the two last-mentioned quantities may differ very greatly will become clear when we consider the average values of x and $1/x$ between $x=0.001$ and $x=1$. The average value of x is here obviously 0.5005, while a simple piece of integration shows that the average value of $1/x$ is a little more than 6.9; that is to say, the average value of the reciprocal is here approximately 7, while the reciprocal of the average value is approximately 2. The general principle here involved should be carefully noted, since it evidently applies to other matters as well as to temperature rise. Temperature rise happens to be one of the matters in which this mistake has very serious results, causing designers to expect, for example, 300 deg. C. more than they will actually get. This would be quite the usual thing in connection with fuses.

I would once again suggest that the B.E.A.M.A. Council should adopt a more reasonable attitude (with regard to my various other points as well as this one) in fairness to the manufacturers whom it represents.

W. F. Dunton.

Manchester, *October 26th*, 1930.

[This letter has been slightly abbreviated.—Eds. Elec. Rev.]

Phasing out E.h.p. Cable Joints.

The letter of "Foreman Jointer" in your issue of October 17th calls for reply in order to correct what appears to be a wrong impression as to the object and value of cable-core colours. As a means of identification core colouring is advisable in all cables, but, in the extent to which this is utilised in jointing lengths together, regard must be had to the incidence of certain conditions on the efficiency of the cable.

The suggestion that colour-to-colour jointing facilitates fault location has little or no value in practice. No experienced engineer would trust his eyesight (very likely at night) to select core colours for the purpose of conducting further tests; time is too precious, and the majority of openings are made at joints where the core papers become discoloured by the sleeve compound. Besides, in these days of efficient testing equipment—and thanks also to heavy fault currents—there is little difficulty in locating faults on h.p. cables. Again, no one would risk crossing the phases of an e.h.p. main when cutting out a length for the purpose of looping into a new sub-station. No, the risks are too great, and the simple and sure practice of testing out the phases by earthing one at a time at the terminal ends is almost universal practice. Unlike most cases of l.p. cables, frequent connections are not called for on e.h.p. cables, and, as they must be made "dead" for any work, there is little object in observing colour-to-colour jointing.

Further, should the "lay" of the cores in two abutting lengths be opposite, it is possible to have a 180 deg. cross and no one considers this a satisfactory joint. The crossing of cores is necessary at times to correct phase rotation, but this is kept to a minimum by correcting at terminal dividing boxes. Whilst agreeing that under good conditions it is practicable, the consensus of opinion is that it is unwise to jeopardise important high-pressure cables by unnecessarily disturbing the dielectric to gain what can only be considered a trifling advantage.

The case of l.p. cables is quite different. Colour-to-colour jointing is not only practicable, but under modern conditions—requiring continuity of supply—highly desirable, as the frequency of tapping for service connections renders "live" jointing essential. L.p. networks consist largely of multi-core feeder-distributors or plain distributors, and these present little difficulty in jointing colour to colour in the average range of sizes.

Further, the cables are generally looser in "make-up," there is less dielectric and therefore greater flexibility of core, and the arrangement of phase separation in joints is such as to render the crossing of cores possible where necessary. L.p. cables with exceptionally large conductors are usually feeders, and are therefore similar to e.h.p. cables in being rarely tapped between sectionalising points. By laying such cables with the lay of the cores in the same direction, it is possible in most cases to joint colour to colour, but where the lay is unknown, or the cable make-up is such as to introduce undue straining of the dielectric to bring the cores opposite, it is preferable in the case of these feeder cables to avoid impairing the life of the cable and to joint the cores at random.

Mains Construction.

October 22nd, 1930.

"Tales Engineers Tell."

The interesting article under the above heading by Mr. J. E. Wallace in the Electrical Review of October 17th will no doubt inspire many of your readers to be humorously reminiscent.

I, personally, can vouch for the veracity of the following incident.

A small engine and electric generator had been installed to provide a supply of electricity to a country house, and the plant was left to the tender mercies of the gardener and handy man.

The contractor who had installed the plant called one day and, meeting George the "engineer-gardener," inquired if the generator was working satisfactorily.

"Ay, she be fine, sir," said George, his face beaming with honest pride, "she sparks a treat."

It is hardly necessary for me to add that the dynamo in question was *not* made in Ipswich!

S. F. Steward.

Ipswich, *October 20th*, 1930.

Mandi Hydro-Electric Scheme.

No one is more pleased than I am to see Mr. C. F. Strickland's defence of the above in your issue of October 24th, p. 679, but may I point out that, in reviewing the report of the Committee of Inquiry into the prospects of the scheme, my criticisms were directed against the project *as put forward*, not on the revised version of the Committee? In basing its recommendations on a minimum flow of 100 cusecs the Committee may or may not be justified—time alone can show—but the original scheme was *not* based on any such figure. Mr. Strickland's 150 cusecs for 95.5 per cent. of the time may be right, but he cannot have missed the outspoken remarks of the Committee on the absence of any continuous recording gauge, and minima may have occurred of which nothing is known. I have seen it stated that the discharge has been down to 25 cusecs, though I should doubt it.

I agree with Mr. Strickland that the Shannon scheme is financially quite a good parallel case; it yet remains to be seen how that will pay, in a land where, after all, every one is at least a potential consumer. In this respect the two are poles apart.

Special pleading could go no further than the suggestion that part of the capital cost of the scheme, having been incurred on the first instalment for the benefit of the second (*not* the third) stage, should be debited to the later stages. That would be all very well if there were the remotest chance of even the second stage materialising, but there is not; hence these tears! If more power is ever required it will not come from the Uhl River if cheaper sources are available, and it is common knowledge that they are.

J. W. Meares.

Chichester,
October 26th, 1930.

A Motor Advertisement.

We must correct one or two of the sweeping statements made by Mr. Constad in his letter under the above heading published in your issue dated October 24th.

Our type "S" repulsion start, induction running motors, fitted with brush-lifting gear and short circuiting device, are equal in all respects to the foreign-made motors, and as regards price, this is sufficiently competitive to attract purchasers.

We agree with Mr. Constad's statement that buyers of electric motors know their business—this is evidenced by the growing demand we experience for this class of motor. As regards the "implied suggestion"—this was not ours but rather that of the "buyers" that Mr. Constad delicately referred to.

Higgs Motors,
SIDNEY J. VAUGHTON,
Sales Manager.

Birmingham.
October 25th, 1930.

[We have received a letter from Normand Electrical Co., Ltd., which expresses itself in entire agreement with Messrs. Higgs Motors, namely, that, apart from the question of price, the British motor buyer has no inducement to purchase foreign machines.—EDS. ELEC. REV.]

Assisted Wiring Schemes.

I have been particularly interested in the report of the Committee appointed by the Electricity Commissioners on Assisted Wiring and the Hiring and Hire Purchase of Electrical Apparatus. The experience we have gained at Wallasey bears out paragraph 13 on page 6 of this report, and it may be of interest to state briefly the demand made so far as this borough is concerned.

My council sanctioned an assisted-wiring scheme on April 3rd last, and the scheme was immediately set in operation; for the first six months' working 3,550 applications have been received, and 2,172 consumers connected to the mains. The applications are still coming in at practically the same rate, and I am wondering if other authorities have experienced a similar demand.

These figures seem remarkable insofar as the population is approximately 100,000, with 24,458 inhabited houses, and 13,561 consumers already connected to the mains prior to April 1st this year.

B. T. Hawkins.

Wallasey, *October 23rd*, 1930.

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1929.

10,490. "Safety devices for electric current-distributing installations." Rheinisch-Westfalisches Elektricitätswerk Akt.-Ges. April 7th, 1928. (309,182.)
10,645. "Thermionic or like amplifying systems." British Thomson-Houston Co., Ltd. April 7th, 1928. (309,187.)
13,707. "Electric discharge devices." H. J. Spanner and U. Doering. May 2nd, 1928. (310,895.)
16,844. "Heating devices for attaining high temperatures by means of electric heating resistances." Dr. F. Neumann. May 31st, 1929. (Convention date not granted.) (312,932.)
16,925. "Electro-magnetic relays." Allmänna Svenska Elektriska Aktiebolaget. October 15th, 1928. (335,956.)
17,116. "Television." F. C. P. Henroteau. June 4th, 1929. (335,958.)
18,109. "Electric terminals, couplings, connectors, and the like." Belling and Lee, Ltd., and E. M. Lee. April 14th, 1930. (335,642.)
19,158. "Electric switches." R. J. Tugwood (G.M.S Products, Inc.). June 21st, 1929. (335,925.)
19,768. "Process and apparatus for electrolytically manufacturing metal sheets and tubes." E. Kelsen. June 27th, 1928. (Patent of addition not granted.) (314,444.)
19,822. "Electrical condensers." Polymet Manufacturing Corporation. February 4th, 1929. (335,927.)
19,823. "Electrical condensers." Polymet Manufacturing Corporation. February 4th, 1929. (335,915.)
19,903. "Wireless systems for use in navigation." Graham Amplion, Ltd., D. Sinclair, A. D'A. Hodgson, and W. J. Rickets. June 28th, 1929. (335,967.)
20,173. "Electric gaseous-discharge devices." British Thomson-Houston Co., Ltd. July 2nd, 1928. (314,811.)
20,174. "Amplifying systems employing thermionic valves." British Thomson-Houston Co., Ltd. July 9th, 1928. (315,219.)
20,195. "Electric incandescent lamps." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabriken). July 1st, 1929. (335,903.)
20,304. "Electrical measuring and protective apparatus for alternating-current circuits." Nalder Bros. & Thompson, Ltd., and C. L. Lipman. July 2nd, 1929. (335,971.)
20,370. "Electro-optical transmission systems." Electrical Research Products, Inc. July 11th, 1928. (315,308.)
20,385. "Electric signalling systems and apparatus used therein." Standard Telephones & Cables, Ltd., S. Chapman, and W. Lawrence. July 3rd, 1929. (335,934.)
20,386. "Composite signalling system." Standard Telephones & Cables, Ltd., and A. D. Blumlein. July 3rd, 1929. (335,935.)
20,387. "Electrical system for communicating with moving vehicles." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). July 3rd, 1929. (335,936.)
20,388. "Telephone transmission systems." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). July 3rd, 1929. (335,937.)
20,389. "Switching arrangements for automatic or semi-automatic telephone systems." Standard Telephones & Cables, Ltd., and J. H. E. Baker. July 3rd, 1929. (335,938.)
20,390. "Selector switches for telephone systems." Standard Telephones and Cables, Ltd., C. P. Smith, and M. S. Snell. July 3rd, 1929. (335,939.)
20,439. "Methods of and apparatus for detecting flaws in electrical conductors." Sperry Development Co (August 10th, 1928 (317,070.)
20,473. "Mounting of sound-producing oscillators of sound-receiving apparatus on ships." Submarine Signal Co. July 7th, 1928. (314,998.)
20,637. "Telegraphic and similar repeating systems employing vacuum tube amplifiers." Electrical Research Products, Inc. July 19th, 1928. (315,836.)
20,821. "Electrolytic apparatus." A. E. Knowles. July 6th, 1929. (Addition to 320,388.) (335,987.)
20,826. "Electrical control of apparatus such as railway points and signals from distant points." Westinghouse Brake & Saxby Signal Co., Ltd. July 9th, 1928. (315,220.)
20,851. "Electrically-propelled vehicles." G. H. Fletcher and Associated Electrical Industries, Ltd. July 6th, 1929. (335,991.)
21,197. "Process for carrying out the electrolysis of fused electrolytes and apparatus for carrying out such process." Hirsch Kupfer-und Messingwerke Akt.-Ges. August 7th, 1928. (316,960.)
21,456. "Method of promoting chemical reactions and physical processes by the use of a high-frequency rotary electric field." W. Ludke. July 12th, 1928. (315,367.)
21,498. "Gaseous conduction electric lamps." British Thomson-Houston Co., Ltd. July 12th, 1928. (315,369.)
21,877. "Cooling systems for X-ray tubes." British Thomson-Houston Co., Ltd. July 16th, 1928. (315,721.)
22,344. "Frame aerials." L. Blundell and W. H. Curtis. July 20th, 1929. (336,023.)
22,743. "Thermionic valve amplifiers." H. Branton, H. G. Bawtree-Williams, E. A. Bitton, and H. Austin Storry, Ltd. July 24th, 1929. (336,028.)
23,219. "Electric clocks." M.P. Favre-Bulle. July 29th, 1929. (336,033.)
23,767. "Oil-break electric switchgear arrangements." Crompton Parkinson, Ltd., and H. Astbury. August 2nd, 1929. (336,038.)
24,338. "Electric cells." Pritchett & Gold & E.P.S. Co., Ltd., and H. M. Genese. August 9th, 1929. (336,041)
25,121. "Directional antennæ." Marconi's Wireless Telegraph Co., Ltd. September 7th, 1928. (318,619.)
25,274. "Thermionic rectifiers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 24th, 1928. (336,047.)
25,367. "Electrical transformers." J. B. Hansell and Associated Electrical Industries, Ltd. August 20th, 1929. (336,048.)
25,816. "Electromagnetically-operated valves." J. L. Musgrave and R. Crittall & Co., Ltd. August 24th, 1929. (336,053.)
28,697. "Automatic amplitude-limiting device for electric circuits." C. Lorenz Akt.-Ges. September 22nd, 1928. (319,374.)
28,774. "Electrical resistance furnaces." P. Carlberg. September 23rd, 1929. (336,078.)
29,218. "Production of alternating currents for driving synchronous motors for synchronisation purposes." Telchar Akt.-Ges. November 7th, 1928. (336,082.)
29,484. "Loud-speaking telephones." General Electric Co., Ltd., F. Clarke, and N. J. McAinsh. September 30th, 1929. (336,084.)
30,409. "Multiplex high-frequency signalling systems." Marconi's Wireless Telegraph Co., Ltd., (C. W. Hansell). October 7th, 1929. (Convention date not granted.) (336,096.)
30,487. "Electric resistance furnaces." W. J. Millar and Electric Furnace Co., Ltd. October 8th, 1929. (336,097.)
30,597. "Electric tumbler switches." R. A. Jones and British Brass Fittings, Ltd. October 9th, 1929. (336,098.)
31,044. "Electrical switches with pneumatic blow-outs." S. Ruppel. October 13th, 1928. (336,102.)
31,250. "Electro-magnetic chuck." Magnet-Werk Ges. Eisenach Spezialfabrik für Elektro-Magnet-Apparate. December 14th, 1928. (336,105.)
32,385. "Electrostatic loud-speakers." H. J. Kuchenmeister. October 24th, 1929. (336,116.)
33,870. "Means for obtaining heating-current for the filaments of thermionic valves from a rectified alternating-current or a pulsating direct-current source." Telefunken Ges. für Drahtlose Telegraphie. November 8th, 1928. (336,128.)
34,650. "Winding for dynamo-electric machines." British Thomson-Houston Co., Ltd. November 14th, 1928. (336,134.)
35,340. "Thermionic-valve circuits." British Thomson-Houston Co., Ltd. November 20th, 1928. (336,138.)
36,479. "Transformers." British Thomson-Houston Co., Ltd. November 28th, 1928. (336,147.)
37,027. "Electric illuminated advertising signs." M. Haase. December 3rd, 1929. (336,153.)
37,146. "Wide-span cable connector for high-voltage lines." K. Pfisterer. April 3rd, 1929. (336,156.)
37,238. "Systems for reproduction of spund, and selenium cell for use in such systems." British Acoustic Films, Ltd. December 5th, 1928. (336,157.)
38,633. "Terminal-board devices for connecting measuring instruments and meters to electrical large-current installations." A. Egger and J. J. Buser Akt.-Ges. December 20th, 1928. (Addition to 323,044.) (336,166.)
38,813. "Electric furnaces." British Thomson-Houston Co., Ltd. December 18th, 1928. (336,168.)

1930.

2,246. "Protective devices for electric apparatus." British Thomson-Houston Co., Ltd. January 22nd, 1929. (336,184.)
4,932. "Triple-pole electric switches." Siemens-Schuckertwerke Akt.-Ges. March 16th, 1929. (336,191.)
5,540. "Portable electric hot-air blowers." Siemens Schuckertwerke Akt.-Ges. February 21st, 1929 (336,192.)
6,520. "Sparking plug for internal-combustion engines." A. Coenders and C. Potz. March 2nd, 1929. (Addition to 311,617.) (336,194.)
8,542. "Spring device for guiding the coil of an electro-dynamic loud-speaker." C. Jorgensen. March 22nd, 1929. (336,196.)
24,835. "Television." F. C. P. Henroteau. June 4th, 1929 (Divided application on 335,958.) (335,995.)
28,474. "Electrical musical instruments." M. L. E. Martenot. April 2nd, 1928. (Divided application on 10,272/29.) (335,997.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from October 22nd:—

Gecalloy. No. 514,422. Class 5. Unwrought and partly wrought metallic alloys for use as cores for electric inductances.—General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.

Volmag. No. 515,590. Class 6. Dynamos for operating bicycle lamps.—Voltalite, Ltd., 107, Frederick Road, Pendleton, Manchester.

Delarelle. No. 515,031. Class 8. Electric lighters for cigarettes.—Delarelle, Ltd., 30, Newgate Street, E.C.1.

Radslot, No. 515,225, and Slotrad, No. 515,226. Class 8. Electrical prepayment meters.—Venner Time Switches, Ltd., 45, Horseferry Road, S.W.1.

Saia. No. 511,804. All goods in Class 13.—Gesellschaft für Schalt-Apparate, Berne, Switzerland. (British representatives: Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Sunhouse (lettering and design). No. 515,136. Class 13. Electric irons, kettles, lamp standards, brackets and fittings, &c.; No. 515,137. Class 18. Electric cooking and heating apparatus; and No. 515,135. Sunhouse (lettering only). Class 18. Electric cooking and heating apparatus.—H. Frost & Co., Ltd., 35, Fieldgate, Walsall.

Linolia. No. 506,786. Class 50. Electrical insulating substances.—Lindsay and Williams, Ltd., Bennett Street Works, Ardwick, Manchester.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERDEEN.—Alterations to Grand Hotel (£20,000); J. G. Ross, manager, 12, Deemount Road.

ASHBY-DE-LA-ZOUCH.—Houses (112), Oakthorpe, Ravenstone, and Swarmington; surveyor to R.D.C.

BAKEWELL.—Cinema, Market Street, for the Holmewood Picture Palace Co., Ltd.; Wilcockson & Cutts, architects, 12, Saltergate, Chesterfield.

BARKING.—Four schools for the E.C.; education architect.

BASINGSTOKE.—Houses (126) for the T.C.; borough surveyor.

BIRMINGHAM.—Extensions at ten schools (£20,000) for the E.C.

BOLTON.—Works extension, Mallison Street; Astley Dye and Chemical Co.

BOURNEMOUTH.—Garage, Westover Road, for Motor Macs, Ltd., 35, Holdenhurst Road; Seal & Hardy, architects, Hampstead House, 13, Yelverton Road.

BRAMHALL.—Branch bank premises for the District Bank, Ltd.; Henry Bardsley & Sons, Ltd., builders, Booth Street, Stockport.

BRIGHTON.—Houses (800), Lewes Road; Chichester Estates Co., Ltd.

BURTON-ON-TRENT.—Factory for the Civilian Aircraft Co., Ltd., Burton; H. D. Boultbee, managing director.

BURY ST. EDMUNDS.—Houses (32) for the T.C.; borough surveyor. School, with lighting and heating work, for the borough E.C.; director of education.

BUSHEY.—Houses (36) for the U.D.C.; surveyor.

CAERPHILLY.—Houses (50) for the U.D.C.; surveyor.

CHELMSFORD.—Garages for the National Omnibus & Transport Co., Ltd.; A. Wiseman, architect, 10, Duke Street.

CHESHIRE.—Extensions, Winsford secondary school, for the County E.C.; F. A. Browne, county architect, Newgate Street, Chester.

CONGLETON.—Electric lighting installation, Town Hall (£600), for the T.C.; A. Ellis, consulting engineer.

CROYDON.—Baths, with laundry, &c., Thornton Heath, for the T.C.; borough engineer.

CUMNOCK.—Houses (50) for the T.C.; burgh surveyor.

DEVIZES.—Electric lighting installation, St. John's Church (£240); Captain W. L. D. Gundry, technical adviser to the Parochial Committee.

DEVON.—School, Torrington, for county E.C.; director of education, Exeter.

DUNDEE.—Alterations to cinema, Nethergate, for Scottish Cinema and Variety Theatres, Ltd.; Gordon and Scrymgeour, architects, 7, Ward Road, and 39, High Street.

ESHER.—Bank for Lloyd's Bank, Ltd.

ESSEX.—Senior school, Chingford, for the county E.C.; J. Stuart, county architect, Chelmsford.

FELTHAM.—Church and school; rector of St. Lawrence's.

FENTON.—Public baths, Whieldon Road; Stoke-on-Trent city engineer.

GLASGOW.—Schools, Knightswood (£50,000), and Shawlands (£70,000); master of works, Education Committee, Bath Street.

GREAT HARWOOD.—Public library; W. Knowles, Ltd., builders, Darwen.

GRIMSBY.—Fish dock (£1,336,433) for the T.C.; Sir Lindsay Parkinson & Co., Ltd., contractors, 171, Shaftesbury Avenue, London, W.C.

HAM (Surrey).—Re-erection of Wilmer House (mansion) for A. Munro, of Munro, Brice & Co., Broad Street Avenue, London, E.C. (£12,000).

IRISH FREE STATE (Dublin).—Electric lighting and heating of houses (90), Marrowbone Lane, for the Corporation; city architect, Exchange Buildings, Lord Edward Street.

(Waterford).—Electrical installation at County and City Infirmary; J. P. Tierney & Co., electrical engineers, 44, Kildare Street, Dublin.

KENT.—Schools, Northfleet, Swanscombe, and Sidcup; also school extensions, Cranbrook and Nonington, for the county E.C.; W. H. Robinson, architect, Maidstone.

KIRKINTILLOCH.—Houses (44), Lenzie Road area; burgh surveyor.

LANCASHIRE.—Elementary school, Brierfield; S. Wilkinson, county architect, 16, Ribblesdale Place, Preston.

LEAMINGTON.—Houses (190), Shrubland estate, for the T.C.; borough surveyor.

LEEDS.—Extension of sewage disposal works, Rodley (£24,000); city engineer.

LIVERPOOL.—Extensions, St. Paul's Eye Hospital, Oldhall Street; Morrison & Son, Ltd., builders, Grange Terrace, Wavertree.

LONDON (Bow, E.).—Flats (130), brewery site; L.C.C. architect.

(Hackney, E.).—Baths, Shacklewell Lane (£10,227) and Englefield Road (£19,000); borough engineer. Factory, Grove Road; G. W. Dennis.

(Lewisham, S.E.).—Houses, Manor Lane (39) and Verdant Lane (36); B. G. Utting.

(Clapham, S.W.).—Houses, Thurleigh Avenue and Nightingale Lane; R. T. Grove.

(Wandsworth, S.W.).—Flats (36), Garratt Lane (£20,280); B. Clarke & Sons.

(Ealing, W.).—Houses, Long Drive; J. P. Blake, architect, Bank House, Hounslow. Shops (10); G. Whittaker, architect, 13, Queen Anne's Gate, S.W. School, Wood End, for T.C.; Evan Thomas & Sons, Neath, contractors. R.C. church; parish priest, SS. Peter and Paul's Rectory.

(Kensington, W.).—Extensions, Cadby Hall, for J. Lyons and Co., Ltd.; Holman & Goodham.

LONGTON (Staffs.).—Houses (31), Uttoxeter Road; A. Tomlinson.

MAIDSTONE.—Labour exchange, London Road, for H.M. Office of Works, King Charles Street, London, S.W.

MANCHESTER.—Post office, Levenshulme; H.M. Office of Works (contracts branch), King Charles Street, London, S.W.

MORDEN.—Central Wesleyan hall (£30,000); trustees, Tooting Wesleyan Mission.

NORMANTON.—"Majestic" Kinema (900 seats); F. Mitchell & Sons, architects, 9, Upper Fountaine Street, Leeds.

NORTHANTS.—Schools, Denton (200 places) and Brington Road, Duston (325 places), for the E.C.

NORWICH.—Schools, Lakenham housing estate (800 places) and Thorpe Hamlet (300 places), for the city E.C.; director of education.

PENSNETT.—Houses (56) for Kingswinford R.D.C.; W. Meredith, surveyor, Wordsley, Stourbridge.

QUEENSBURY.—Catholic church; Crossley & Ratcliffe, builders, Halifax.

RADCLIFFE.—Senior school and clinic (£52,935) for the E.C.; Thomas Gornall & Sons, builders, Bolton.

ROTHWELL.—Grammar school; education officer, County Hall, Wakefield.

ROTTINGDEAN. — Sea-front improvement (£25,000); Brighton borough engineer.

RUSHDEN.—Houses (46) for the U.D.C.; J. W. Lloyd, surveyor.

SELBY (Yorks.).—Re-erection of Cyprus Mill for Bardgett Bros.

SLEAFORD.—Houses (50), new estate; U.D.C. surveyor.

SOUTHAMPTON.—Extension of docks (£3,000,000) for Southern Railway Co.

STOCKPORT.—'Bus depôt for the T.C.; H. Hamer, borough surveyor.

STOKE-ON-TRENT.—Hospital pavilion (£31,500); Gee, Walker & Slater, Ltd., Derby.

SURBITON.—Library and fire station, with flats (£23,000) and baths (£16,000), for the U.D.C.; surveyor.

TORQUAY. — Alterations and improvements, pavilion (£10,000), for the T.C.; borough engineer.

TYNEMOUTH.—Flats (104), Blakwell estate (£34,123); J. Carruthers & Son. Aerodrome; borough engineer.

WATFORD.—Extensions, boys' grammar school, for the governors; F. Wilson, clerk, 7, Church Street.

WETHERBY.—Sewage disposal works; F. J. Rodwell, engineer, 20, Park Row, Leeds.